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JOHN GEORGE JACK. 1861-1949.

With portrait.

ON MAY 20, John George Jack, Assistant Professor of Dendrology, *Emeritus*, at the Arnold Arboretum, died at the age of eighty-eight years at his home, "Folly Farm," in East Walpole. He had been confined to his bed since August of the preceding year, having broken his hip while working in his orchard.

John George Jack was born in Chateaugay, Quebec, Canada, on April 15, 1861. His mother, Mrs. Annie L. Jack, originally a school-teacher, was a well-known horticulturist. She produced a series of articles under the title of "Garden Talks" and wrote a handbook on "The Canadian Garden." Undoubtedly his mother's influence was responsible for Professor Jack's early interest in horticulture. Although Professor Jack's formal education did not extend beyond high school he acquired a thorough knowledge of plants from practical experience and long study. He was outstanding as a field worker in detecting variations and species-hybrids.

In 1886, Professor Jack first came to the Arnold Arboretum to work and study under Professor C. S. Sargent and in 1891 he was appointed Lecturer at the Arnold Arboretum. He served as Instructor in Forestry at Harvard from 1903 to 1908, and as Lecturer in Forestry at the Massachusetts Institute of Technology from 1899 to 1908. He was made an Assistant Professor of Dendrology in 1908. Although Professor Jack spent most of his time at the Arnold Arboretum where he was a staff member from 1891 until he was retired in 1935, he was also on the staff both of the Bussey Institution and the Harvard Forest.

Even though most of Professor Jack's time was spent on the Arnold Arboretum grounds checking identifications of the trees and shrubs, lecturing to field classes, and supervising the plantings, he made many collecting trips to various parts of the world. The early trips were financed by funds obtained by Professor Jack himself from outside sources since at first the Arnold Arboretum had little money for exploration and Professor Jack's salary was only \$500.00 per year. In 1891 he visited the botanic gardens and nurseries in France, Germany, Italy, Denmark and

England and in 1904 with Professor Alfred Rehder he made extensive collections in the western United States and Canada. In 1905 he went to Japan, Korea and China, where he studied both native and cultivated ornamental plants sending seeds and cuttings back to the Arnold Arboretum. Nearly every year from 1926 to 1936 Professor Jack went to the Atkins Botanical Garden in Cuba for a few months where he worked with the collections in the garden and collected native species in the vicinity of Soledad.

In 1907 Professor Jack married Cerise Emily Agnes Carmen, daughter of Elbert S. Carmen, who published the "Rural New Yorker." They adopted two children. Mrs. Jack died in 1935. Their daughter, Betty Wirth, and her husband lived with Professor Jack in his later years at "Folly Farm" in East Walpole.

Professor Jack was especially interested in trees, but like all old-time naturalists his interests covered the entire range of biology. His knowledge of plants, his spontaneous enthusiasm and sincerity, made him an outstanding teacher of field classes. He made many friends for himself and for the Arnold Arboretum.

Taxonomists are a hardy race, but few could keep up with Professor Jack. While spending a month with him at the Atkins Garden in 1936, I discovered that although he was 75 years old Professor Jack was up at 6 A.M., worked all day, often traveling into the surrounding country on horseback, and continued to work until 11 or 12 o'clock at night. Later I visited him at his farm on his 85th birthday where I found him spraying his orchard. He complained that he couldn't work after supper as formerly when he was younger.

Professor Jack published several hundred papers beginning in 1888. Most of these were notes on various plants grown in the Arnold Arboretum and descriptions of field work. His earlier contributions were published in "Garden and Forest" and in various horticultural journals. Many of his later publications appeared in the *Bulletin of Popular Information* published by the Arnold Arboretum.

In recognition of his work in taxonomy the following species were named for Professor Jack: —

- Sinojackia* Hu, a new genus with two species from China.
- Alnus Jackii* Hu (= *A. trabeculosa* Hand.-Mazz.).
- × *Amelasorbus Jackii* Rehd.
- × *Betula Jackii* Schneid.
- Crataegus Jackii* Sarg.
- Juniperus communis* var. *Jackii* Rehd.
- × *Populus Jackii* Sarg.
- × *Quercus Jackiana* Schneid.
- Rosa Maximowiczii* var. *Jackii* (Rehd.) Rehd. (*R. Jackii* Rehd.).
- × *Sorbaronia Jackii* Rehd. (*Pyrus Jackii* [Rehd.] Fernald).
- × *Viburnum Jackii* Rehd.

The hybrids (×) were discovered by Professor Jack.

A SELECTED BIBLIOGRAPHY OF THE WRITINGS OF JOHN GEORGE JACK.

- 1888-1889. Notes from the Arnold Arboretum. (Garden and Forest, vol. 1 & 2.)
- 1890-1892. Notes on shrubs. (Garden and Forest, vol. 3 & 5.)
- 1891-1893. Notes of a summer journey in Europe, I-XXIV. (Garden and Forest, vol. 4.)
1891. Notes on some hardy wild roses, I-V. (Garden and Forest, vol. 4.)
1894. Notes on some injurious insects. (Trans. Mass. Hort. Soc. 1: 1-20.)
1894. Notes on trees and shrubs. (Garden and Forest, vol. 7.)
- Native trees and shrubs about Montreal, Canada, I-V. (Garden and Forest, vol. 7.)
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1900. The Pikes Peak, Plum Creek, and South Platte forest reserves. (20th Annual Rept. U. S. Geol. Survey 1898-99: pt. 5.)
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1911. Trees and other woody plants found in the Harvard Forest, Petersham, Massachusetts. (Bull. Harvard Forestry Club 1: 10-26.)
1930. Planting trees in autumn. (Bull. Pop. Inf. ser. 3, 4: 65-68. illustr.)
1931. Forsythias. (Bull. Pop. Inf. ser. 3, 5: 9-12. illustr.)
- Flowering cherries. (Bull. Pop. Inf. ser. 3, 5: 13-16. illustr.)
1935. Winter injuries among trees and shrubs. (Scientific Monthly, 40: 332-338.)
1936. Arboreta, old and new. (Scientific Monthly, 41: 541-550.)

Professor Jack was a member of the Society of Foresters, Botanical Society of America, Massachusetts Horticultural Society, American Academy, Boston Society of Natural History, and Deutsche Dendrologische Gesellschaft.

With the passing of Professor Jack, the era of the old-time naturalist is drawing to a close. Largely self taught, with enthusiastic interest in all phases of nature, and with apparently unlimited energy, these early botanists made the contact between botanical science and the horticultural public which led to the establishment and maintenance of so many of our botanic gardens and parks.

KARL SAX

THE GENUS ILEX IN CHINA, II

SHIU-YING HU

Continued from page 344

SECTION VII. AQUIFOLIUM GRAY

Ilex § *Aquifolium* Gray, Man. Bot. N. U. S. 276. 1848; Maxim. in Mém. Acad. Sci. St. Pétersb. VII. 29(3): 26. 1881; Rehd. Bibliog. Cult. Trees Shrubs 399. 1949.

Ilex subgen. *Ewilex* Loes. series C. *Aquifolium* (Maxim.) Loes. in Verh. Bot. Ver. Brand. 33: 26. 1891, in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 219. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 227 (Monog. Aquif. 1: 227). 1901.

Evergreen trees or shrubs with fasciculate inflorescences in the axil of the leaves of the second year's or even older growth, the pyrenes 4, rarely less, with stony or woody striate and sulcate or rugose and pitted endocarps.

Forty-seven species in five series occur in China. Most of the species are locally endemic. The range of the five series is as illustrated in figure 8.

KEY TO THE SERIES

- A. Leaves spinose or entire with the apex ending in a spine (except *Ilex hylonoma*).
 - B. Pyrenes stony, irregularly wrinkled and pitted; fruit always containing 4 pyrenes.....Series 1. *Aquifolioides*.
 - BB. Pyrenes woody, palmately striate; fruit containing 2 pyrenes....
.....Series 2. *Dipyrenae*.
- AA. Leaves entire, serrate or crenate, those from the mature plant never spinose.
 - B. Pyrenes irregularly wrinkled and pitted, the endocarp stony; fruit 8-12 mm. in diameter; stigma navel-like, rarely discoid.....
.....Series 3. *Denticulatae*.
 - BB. Pyrenes palmately striate and sulcate; fruit 4-6 rarely up to 8 mm. in diameter; stigma discoid, capitate, rarely navel-like.
 - C. Leaves chartaceous or subcoriaceous, when dry brunneous, with impressed veinlets on the upper surfaces; fruiting pedicels 4-7 mm. long.....Series 4. *Hookerianae*.
 - CC. Leaves thick coriaceous, coriaceous, rarely subcoriaceous, the veinlets obscure or plane above, never impressed; fruiting pedicels 2-4 mm. long.....Series 5. *Repandae*.

SERIES 1. AQUIFOLIOIDES (LOES.), STAT. NOV.

Ilex subgen. III. *Euilex* Loes. ser. C. *Aquifolium* (Gray) Loes. sect. 2. *Aquifolioides* Loes. in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 219. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 244 (Monog. Aquif. 1: 244). 1901.

Trees or shrubs with spinose or coarsely serrate leaves, fasciculate inflorescences, the individual branches of the staminate fascicles 1-3-flowered, those of the pistillate fascicles uniflorous, the flowers 4-merous, the fruiting pedicels 2-12 mm. long, the fruit large, 6-12 mm. in diameter, the pyrenes wrinkled and pitted, the dorsal surfaces convex, and the endocarp stony.

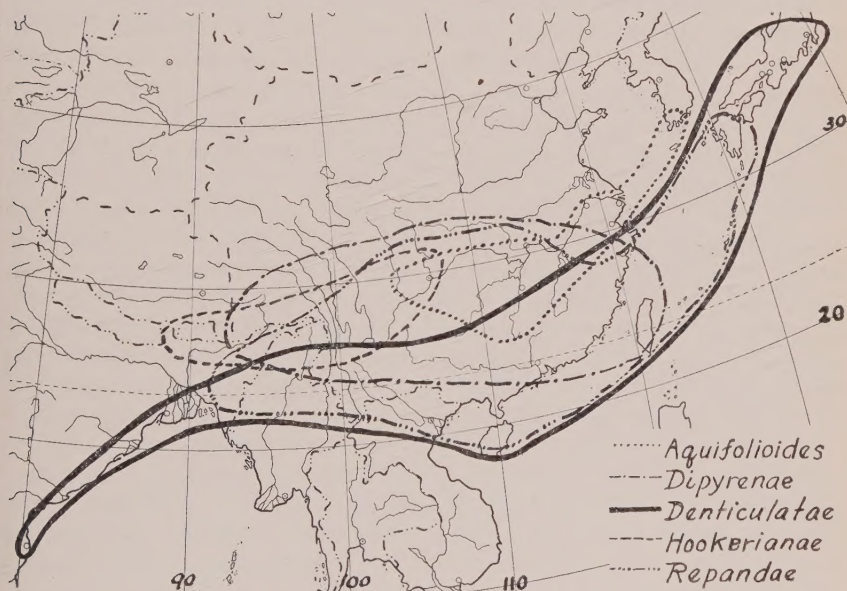


FIG. 8. Geographic distribution of the Chinese representatives of the five series of the section *Aquifolium*.

KEY TO THE SPECIES

- A. Fruiting pedicels 2 mm. long; leaves oblong-elliptic or elliptic-lanceolate, the margin spinosely dentate or coarsely serrate.
- B. Individual branches of the staminate fascicles 3-flowered; leaves 6-12.5 cm. long, 2.4-4.5 cm. wide, the margin coarsely serrate, sometimes the teeth ending in weak spines; fruit 10-12 mm. in diameter with a discoid or mammiform stigma. (Szechuan, Kweichow, and Kwangsi).....37. *I. hylonoma*.
- BB. Individual branches of the staminate fascicles uniflorous; leaves 6-7 cm. long, 1.5-2.8 cm. wide, the margin 4-10 spinose-dentate; fruit 6-7 mm. in diameter, with a thin-discoid stigma. (Hupei-Szechuan border).....38. *I. centrochinensis*.

AA. Fruiting pedicels 5–18 mm. long; leaves quadrangular-oblong, rarely ovate, the margin entire or sinuate with 1–3 rigid spines on each side. (East and Central China).....39. *I. cornuta*.

37. *Ilex hylonoma* Hu & Tang in Bull. Fan. Mem. Inst. Biol. Bot. 9: 250. 1940.

Ilex intermedia sensu S. Y. Hu in Ic. Pl. Omei. 2: pl. 164. 1946, non Loes.

An evergreen tree up to 10 m. high with glabrescent or glabrous branchlets, elliptic or oblong-elliptic, coarsely and sharply serrate, slightly acuminate leaves, large (10–12 mm. in diameter) ellipsoid fruits, and 4 large (7–9 mm. long) bony wrinkled and pitted pyrenes, each with a median longitudinal ridge.

Branchlets straight, castaneous; second year's growth subterete, 3 mm. in diameter, plicate; current year's growth 2 mm. in diameter, slightly angular, striate and sulcate, the terminal buds slender, acute, conic, glabrous, with ciliate bud-scales. Leaves occurring also on second year's growth (3–)25–(37) mm. apart; stipules minute, deltoid, 1 mm. long, acute; petiole 8–14 mm. long, one-eleventh to one-seventh the length of the lamina, canaliculate and minutely puberulent above, rugose beneath; lamina thin-coriaceous, elliptic or oblong-elliptic, 6–12.5 cm. long, 2.4–4.5 cm. wide, acute or obtuse, rarely cuneate at the base, shortly acuminate at the apex, the very tip mucronate; margin coarsely and sharply serrate, sometimes the teeth ending in weak spines; the midrib impressed above, pilose or glabrescent above, elevated and prominent beneath, the lateral nerves 9 pairs, obscurely impressed above, elevated and prominent beneath, branched and anastomosing near the margin, the reticulations of the veinlets evident above, rather obscure beneath. Inflorescences fasciculate, axillary on second year's growth, the bracts deltoid, acute, glabrous and ciliate; flowers 4-merous. Staminate inflorescences: individual branches of the fascicle 3-flowered, sparsely puberulent; peduncles 1 mm. long, the pedicel 3 mm. long, with 2 ciliate basal prophylla; calyx patelliform, 1.8 mm. in diameter, glabrous, the lobes broadly deltoid, obtuse, ciliate, 0.5 mm. long, 0.5–1 mm. wide; corolla rotate, the petals obovate-elliptic, 3.3–3.5 mm. long, 1.8 mm. wide, one-eighth connate at the base; stamens slightly longer than the petals, the anthers ovoid; rudimentary ovary subglobose. Pistillate flower not seen. Infructescences paucifasciculate, the pedicels 2 mm. long, with 2 sub-basal prophylla. Fruit ellipsoid-subglobose, 10–12 mm. in diameter, quite wrinkled when dry, the persistent calyx explanate, 3 mm. across, the stigma prominent, thickly discoid or almost mammiform. Pyrenes 4, obovate in outline, trigonous in cross-section, the apical end obliquely retuse, 7–9 mm. long, 3–4 mm. wide, the dorsal surface irregularly wrinkled and pitted, with a median longitudinal ridge, the endocarp bony.

CHINA: Szechuan: Mt. Omei, *H. C. Chow* 11831 (A); *W. P. Fang* 12579 (A, Sz), 14971 (Sz), 15296 (Sz), 15517 (Sz), 16496 (Sz), 18229 (Sz), 18540 (Sz); *S. N. Hsu* 678 (SS); *T. C. Lee* 3710 (Sz), 4438 (Sz); *W. W. Ma* 2691 (Sz), 2339 (Sz), 2762 (Sz), 2771 (Sz); *G. L. Sun* 135

(Sz), 149 (Sz); T. H. Tu 397 (ISOTYPE, SS); without precise locality, C. W. Yao 3659 (SS). Kweichow: Wong-Mou, Chen-feng, S. W. Tseng 90969 (A), 90969B (A).

Ilex hylonoma was first reported from Mount Omei, the sacred mountain in West China. There it grows as a small tree 3–4 m. high in thickets at altitudes of 950–1200 m., or as a big tree 10 m. high in mixed forests at altitudes of 1300–1700 m. Its yellowish flowers appear in March. The large fruits become brown in October and red in November (ex Fang).

Ilex hylonoma is closely related to *Ilex centrochinensis*. In the thin-coriaceous texture of the leaves, the fasciculate inflorescences, the very shortly pedicellate fruits, and in the sculpturing of the pyrenes, they are almost alike. They differ in that *Ilex centrochinensis* has smaller spinose leaves, uniflorous branches of the staminate fascicles, and smaller pyrenes.

37a. *Ilex hylonoma* var. *glabra*, var. nov.

Arbor glabra; foliis coriaceis vel crasse coriaceis, lanceolatis, oblanceolatis, ovato-lanceolatis vel ellipticis, 6–10 cm. longis, 1.8–4.2 cm. latis, margine serratis vel tenuiter spinosis; fructibus ellipsoideis vel subglobosis, 8–10 mm. diametro, pedicellis 2–3 mm. longis; pyrenis 4, oblongis, trigonis, apice oblique retusis, 6–8 mm. longis, endocarpio lapideo.

Branchlets, terminal buds, pedicels, midrib and petioles all glabrous; leaves coriaceous or thickly coriaceous, lanceolate, oblanceolate, ovate-lanceolate or elliptic, 6–10 cm. long, 1.8–4.2 cm. wide, coarsely serrate or weakly spinose; fruits ellipsoid or subglobose, 8–10 mm. in diameter; pedicels 2–3 mm. long, prophylla 2, median, ciliate; pyrenes 4, oblong-trigonus in outline, 6–8 mm. long, with 1 median longitudinal ridge along the back, the apical end obliquely retuse, the endocarp bony.

CHINA: Chekiang: Chu-an-hsien, Y. L. Keng 726 (A). Hunan: Chang-sa, Handel-Mazzetti 11501 (A, LU). Kwangsi: Hu-chen, R. C. Ching 5386 (NY); Ling-wun, S. K. Lau 28662 (A); Kwei-lin, W. T. Tsang 27796 (TYPE, A; US), 27998 (A, US), 28063 (A, US); Hing-on, Z. S. Chung (T. S. Tsoong) 83691.

Geographically this variety ranges over a wider area than does the typical West China species. It extends from the coastal provinces, Chekiang, westward to the Great Lake Province, Hunan, and southward to Kwangsi. It is a large tree 10 m. high.

This variety differs from the typical West China species in having glabrous branchlets and midrib. The leaves are thicker in texture.

38. *Ilex centrochinensis*, nom. nov.

Ilex aquifolium L. var. *chinensis* Loes. ex Diels in Bot. Jahrb. 29: 435. 1900, nom. nud., in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 236 (Monog. Aquif. 1: 236). 1901, descr., et in Sarg. Pl. Wils. 1: 78. 1913; Hand.-Mzt. Symb. Sin. 7: 655. 1933; Chen, Ill. Man. Chin. Trees 658. 1937.

Ilex aquifolium sensu Franch. in Bull. Soc. Bot. France 33: 453. 1886; sensu Hemsl. in Gard. & Forest 2: 124. 1889, non L.

Ilex dipyrrena Wall. var. *leptacantha* Loes. Il.cc. 436. 1900, nom. nud., 278. 1901, descr. Syn. nov.

An evergreen shrub up to 3 m. high, with slender angular and ridged sparsely puberulent or glabrescent branchlets, lanceolate spinose leaves, fasciculate inflorescences, short-pedicellate fruits, and 4 wrinkled-pitted and median longitudinally ridged pyrenes.

Branchlets slender, longitudinally ridged and rugose, brown or nigrescent; third year's growth 3 mm. in diameter, the lenticels lacking, the leaf-scars deltoid; second year's growth 2–2.5 mm. in diameter, ridged; current year's growth angular, 1.5 mm. in diameter, puberulent or glabrescent, sharply ridged from the stipules downward, the terminal buds thin, acute-conic, puberulent or glabrescent with ciliate bud-scales. Leaves occurring also on the second year's growth, 5–15 mm. apart; stipules deltoid or obliquely deltoid; petioles 5–8 mm. long, one-eleventh to one-ninth the length of the lamina, very shallowly impressed above; lamina coriaceous, brown, shiny above, less so beneath, elliptic-lanceolate, rarely ovate-elliptic, 5–9 (usually 6–7) cm. long; 1.5–2.8 cm. wide; obtuse or rarely rounded at the base; acuminate at the apex, the acumen deltoid, 6–12 mm. long, terminating in a spine; margin spinose-dentate, the spines 4–10 on each side, 2–4 mm. long, the tips nigrescent; midrib shallowly impressed above, puberulent near the base, elevated beneath, the lateral nerves 6–8 pairs, obscure, rarely evident above, obscure or rarely prominent beneath. Inflorescences fasciculate, axillary on the second year's growth; the bud-scars often persistent, broadly ovate, cartilaginous, puberulent or glabrescent, the individual branches of the fascicles uniflowered, the bracts ovate-lanceolate, pubescent, ciliate; flowers 4-merous. Staminate flowers: pedicels 1–2 mm. long, puberulent, with 2 median ciliate prophylla reaching the calyx; calyx patelliform, 2.5 mm. across, deeply lobed, the lobes ovate, deltoid, ciliate and often puberulent; corolla rotate, 6 mm. across, the petals oblong, 3 mm. long, the distal half ciliate, one-eighth connate at the base; stamens longer than the petals, the anthers oblong-ovate; rudimentary ovary subglobose, the apex rounded. Pistillate flower not known. Infructescences paucifasciculate, the fascicles with 1–3 fruits, the pedicels 2 mm. long, puberulent, with 2 sub-basal ciliate prophylla; persistent calyx explanate, quadrangular in outline, 2 mm. across, the lobes ciliate. Fruit globose, 6–7 mm. in diameter, the stigma thin-discoid, 4-lobed. Pyrenes 4, oblong-trigonus in outline, ca. 6 mm. long, 3 mm. wide at the back, wrinkled and pitted all over, the dorsal surfaces with a median longitudinal ridge, the ends obtuse, the endocarp stony.

CHINA: Hupei (Hupeh): Chien-shih-hsien, *H. C. Chow* 1523 (A, NY); Nan-yang-ho, western Hupei, *W. Y. Chun* 3857 (A); Ichang, *A. Henry* 1084 (TYPE, fruit, G), 3299 (A, G, US); 4239 (TYPE of *Ilex dipyrena* var. *leptacantha*, A); *E. H. Wilson* 108 (A, NY), 295B (A), 3100 (A, US). Szechuan: *E. Faber* 87 (NY); Wu-shan-hsien, *E. H. Wilson* 1028 (A); *W. Y. Chun* 4098 (A).

This species is endemic to the Hupei-Szechuan border where the Yangtze River cuts through the limestone mountains forming the famous huge deep gorges. It is in this area that *Metasequoia* has recently been dis-

covered. There *Ilex centrochinensis* grows as a shrub along the roadside, margin of the woods or by small streams at altitudes of 500–700 m. The flowers appear in March and April, and the fruit turns purplish red in middle August (ex Chun) or is still green in September (ex Chow).

In indumentum and leaf characters, *Ilex centrochinensis* is most closely allied with *Ilex aquifolium* Linn., but the latter has 3-flowered branches in the staminate inflorescences, fruiting pedicels as long as or longer than the diameter of the mature fruits, reticulately striate and sulcate pyrenes which lack a distinct median longitudinal ridge on the back. Moreover, *Ilex aquifolium* Linn. does not occur in any part of China unless cultivated. In the color and texture of the dry leaves, the nature of the inflorescences, the short fruiting pedicels, and in the character of the pyrenes, *Ilex centrochinensis* is very closely related to *Ilex hylonoma* Hu and Tang, but the latter has larger (up to 12 cm. \times 4 cm.) serrate leaves, and much larger fruits (up to 12 mm. in diameter).

Loesener with the specimen A. Henry 4239 created the variety *Ilex dipyrena* Wall. var. *leptacantha*, basing it upon *Ilex leptacantha* Lindl. & Paxt. But the specimen he examined does not belong to the species as he supposed. It is a fruiting specimen. Each fruit has 4 stony, wrinkled-pitted, longitudinally ridged pyrenes which are typical of *Ilex centrochinensis*. It is apparently a branch from a vigorously growing plant. The leaves are larger and thinner, and the lateral nerves are more evident above than in the other Henry specimens. But this variation is very common in any growing shrub.

39. *Ilex cornuta* Lindl. & Paxt. Flow. Gard. 1: 43, fig. 27. 1850, in Gard. Chron. 1850: 311. 1850; Loud. Encyc. Pl. Suppl. 2: 1302. 1855; Hook. in Bot. Mag. 14: pl. 5059. 1858; Moore in Jour. Bot. 16: 137. 1878; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 44. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 115. 1886; Loes. ex Diels in Bot. Jahrb. 29: 436. 1900, in Nov. Act. Acad. Caes. Leop.-Carol. 78: 280 (Monog. Aquif. 1: 280). 1901, et in Sarg. Pl. Wils. 1: 78. 1911; Schneid. Ill. Hand. Laubh. 2: 164. 1912; H. Lévl. in Mém. Real Acad. Cien. y Art. 12: 13. 1916; Gee in Sci. [China] 6: 212. 1921; Chung in Mem. Sci. Soc. China 1: 139. 1924; Liu in Bull. Pek. Soc. Nat. Hist. 2: 126. 1928; Belval, Mus. Heude Not. Bot. Chin. 2: 21. 1933; Hand.-Mzt. Symb. Sin. 7: 656. 1933; Cheng in Contr. Biol. Lab. Sci. Soc. China 9: 171. 1934; Chen, Ill. Man. Chin. Trees 657. 1937.

Ilex cornuta forma *typica* Loes. op. cit. 281. 1901. *Syn. nov.*

Ilex cornuta forma *gaëtana* Loes. l.c. *Syn. nov.*

Ilex furcata Lindl. in hortis: Göppert in Gartenfl. 1853: 322. 1854.

Ilex burfordii S. R. Howell, Descr. Cat. Howell Nurs. 19. 1935, *nom. nud.*

Ilex cornuta var. *burfordii* De France in Nat. Hort. Mag. 13: 193. 1934;

Clarke in Jour. Hort. Soc. 6: 284. 1945.

Ilex cornuta forma *burfordii* (De France) Rehd. in Bibl. Cult. Trees Shrubs 400. 1949. *Syn. nov.*

An evergreen shrub or small tree with firm thick-coriaceous dimorphic leaves varying from cordate or oblong-entire to quadrangular and sinuate-spinose, fasciculate inflorescences, globose drupes, and 4 wrinkled-pitted stony pyrenes, entirely or half-grooved along the dorsal longitudinal line.

Branchlets stout, subterete, cinereous when dry; third year's growth 5 mm. in diameter, longitudinally minutely rimulose, the nodes prominent with elevated leaf-scars, the lenticels lacking; second year's growth 4 mm. in diameter, ochraceous or brown; longitudinally striate-rugose; current year's growth 2-3 mm. long, longitudinally ridged, minutely puberulent in the grooves or glabrescent, the terminal bud small, thin-conical, puberulent or glabrescent. Leaves occurring even on the third year's growth, 5-10 mm. apart; stipules broadly deltoid, callose, ca. 0.4 mm. long, 0.5 mm. wide; petioles 4-8 mm. long, one-seventeenth to one-ninth the length of the lamina, puberulent, narrowly impressed above; lamina thick-coriaceous, olivaceous, shiny above, opaque beneath, quadrangular-oblong, rarely ovate, (3-)5-6(-8) cm. long, (2-)2.5-3(-4) cm. wide; round or truncate at the base; acute or shortly acuminate at the apex, the very tip always terminating in a strong spine; margin entire or sinuate with 1-3 spines on each side, rigid, thickened and of lighter color than the lamina; midrib very slightly impressed (almost plane on the distal half) above, prominent and elevated beneath, the lateral nerves 5 or 6 pairs, anastomosing near the margin, obscure above, evident beneath, the reticulation of the veinlets obscure on both surfaces. Inflorescences fasciculate, sessile, axillary, on second year's growth, the persistent scales suborbicular, cartilaginous, ciliate and sparsely puberulent, 1.5 mm. long, the individual branches of the fascicles unflowered, the bracts ovate, pubescent, ciliate, obtuse or mucronate, with 2 subulate basal appendages; flowers 4-merous. Staminate inflorescences: pedicels 5-6 mm. long, glabrous, with 1 or 2 sub-basal minute broadly deltoid prophylla; calyx patelliform, 2.5 mm. across, the lobes membranaceous, broadly deltoid, sparsely puberulent, ciliate, 0.75 mm. long, 1.5 mm. wide; corolla rotate, 7 mm. across, the petals oblong-ovate, 3.5 mm. long, with the apical ends very sparsely ciliate, one-tenth connate at the base; stamens subequaling or slightly longer than the petals, the anthers ovoid-oblong, 1 mm. long; rudimentary ovary subglobose, the apex obtuse or rounded, indistinctly 4-lobed. Pistillate inflorescences: pedicels 8-9 mm. long, glabrous, after fruiting 13-14 mm. long with minute broad deltoid basal prophylla; calyx patelliform, the lobes obtuse, sparsely puberulent and ciliate; corolla rotate, 7 mm. across, choripetalous, the petals oblong-ovate, 3.5 mm. long, sparsely ciliate; staminodes four-fifths the length of the petals, slightly longer than the ovary, the sterile anthers ovate-sagittate; ovary oblong-ovoid, 3-4 mm. long, 2 mm. wide, the stigma discoid. Fruit globose (ellipsoid before reaching maturity), 8-10 mm. in diameter, the persistent calyx quadrangular in outline, the stigma discoid, distinctly 4-lobed. Pyrenes 4, obovate or elliptic in outline, the ends acute, 7-8 mm. long, 5 mm. wide at the back, wrinkled-pitted, rugose all over, the dorsal surface entirely

or partly canaliculate along the median longitudinal line, the endocarp bony.

CHINA: Kiangsu: Nanking, *Chen & Teng* 3960 (A, US), 3961 (NY); *W. C. Cheng* 383 (SS); *W. P. Fang* 10416 (SS), 61108 (SS). Soochow: *H. F. Feng* in 1925 (G); *Y. L. Keng* 1692 (A, NY); *E. Faber* (NY); Chiu-yong, *K. King* 2175 (G); *A. N. Steward* (ex Herb. Univ. Nanking 1959) (A), 7261 (NY, US); *Y. Z. Sun* 1067 (SS); *Tso* 28 and 210 (A). Chekiang: Moh-kan-san, *S. P. Barchet* (US); Tien-mu-shan, *W. C. Cheng* 3624 (US); Tih-tai-shan, *R. C. Ching* 1374 (A, US); Hangchow, *C. Y. Chiao* (ex Herb. Univ. Nanking 7966) (US); Nin-po, *C. K. Chao* in 1935, (CUB); *S. S. Liu* in 1935 (CUB); Tsing-yunhsien, *Y. L. Keng* 449 (A, SS); Chang-hwa-hsien, *Y. L. Keng* 574 (A); Chun-an-hsien, *Y. L. Keng* 712 (A); Lin-an-hsien, *H. H. Hu* 1562 (A); locality not given, *D. Macgregor* in 1908 (A); Tang-si, *F. H. Meyer* 229 (A); Tien-mo-shan, *T. Tang & W. Y. Hsia* 428 (A). Anhwei: Hwangshan, *S. S. Chien* 1336 (SS); Bau-hua-shan, *W. C. Cheng* 434 (SS, US), 5897 (SS); *C. Pei* 2439 (SS). Kiangsi: Nan-chang, *H. H. Chung* 658 (LU); *J. N. Hsiung* 504 (A); Kian, *F. A. McClure* 3421 (LU); Kao-ping, *Y. Tsiang* 9893 (NY); Kiu-kiang, *E. H. Wilson* 1608 (A, SS). Hupei (Hupei): Wu-chang, *S. C. Sun* 1078 (A, NY); Ichang, *A. Henry* 3292A (G); *E. H. Wilson* 3101A (A, US). Hunan: Tsing-tschou (Chang-sa), *Handel-Mazzetti* 364, 637, 442 (A).

KOREA: Senra, *Taquet* 2721 (A); same province, *E. H. Wilson* 11242 (A).

CULTIVATED: I have seen specimens from the gardens of Kew, England, Hannover and Dahlem, Germany, Locarno, Switzerland, and from gardens and nurseries of Virginia, Tennessee, and Georgia in the United States.

Ilex cornuta is endemic to the hilly regions of the lower Yangtze provinces from the sea up to western Hupei. There its yellow flowers appear in April and the fruit turns red in November.

Ilex cornuta was first introduced to England from the vicinity of Shanghai by R. Fortune in 1846. The first published record of it appeared in 1850. From the very beginning Lindley and Paxton had clearly stated the variation in leaf forms, "Foliis . . . in plantâ vegetiore grossè sinuato-dentatis spinosis in adultâ 3-cornibus integrisque." In 1908 Dallimore commented on Fortune's specimen deposited in Kew, saying, "it appears that the upper leaves on mature trees vary in shape, sometimes being spineless and sometimes bearing but one or two spines." This is correct.

Ilex cornuta is like many other Asiatic spinose species of *Ilex* in that maturity in the plant and aridity in the environment are associated with the reduction of the number of spines on the leaves, often even with entire leaves. Such a dimorphism in leaves is very common with wild *Ilex cornuta*. It has been reported from Chekiang by Keng, from Anhwei by Ching, and in Nanking I have personally seen trees about 5 m. high with some branches bearing entire leaves and others bearing spinose leaves. The type or parent plant of *Ilex cornuta* var. *burfordii* De France in the West View Cemetery, Atlanta, Georgia, must have been propagated

from such an entire-leaved shoot. De France admitted, "When seeds of *Ilex cornuta* var. *Burfordii* germinate they produce seedlings similar to *Ilex cornuta* . . ." Therefore, his variety may be considered as a horticultural clone, but not a taxonomic form or variety.

The branchlets of *Ilex cornuta* are rather flexible. In China they are used by farmers to make nose-rings for cattle. The bark and the leafy shoots are used as medicine. The plant is believed to be an excellent remedy for diseases of the kidney and is commonly administered as a tonic. It is also widely cultivated as an ornamental shrub.

39a. *Ilex cornuta* var. *fortunei* (Lindl.), comb. nov.

Ilex fortunei Lindl. in Gard. Chron. 1857: 868. 1857; Chung in Mem. Sci. Soc. China 1: 140. 1924.

Ilex cornuta sensu Rehd. in Jour. Arnold Arb. 8: 156. 1927, pro parte.

Branchlets minutely puberulent or glabrescent; leaves thick-coriaceous, oblong, obovate-oblong, or quadrangular, the margin entire, occasionally with 2 or 3 strong spines on each side, rigidly thickened; inflorescences fasciculate or in the staminate inflorescence pseudopaniculate with a rachis up to 10 mm. long; individual branches of the staminate fascicles 1-3-flowered, the pedicels 5-15 mm. long, when 3-flowered the peduncles 1-2 mm. long; individual branches of the pistillate fascicles uniflorous, the pedicels 12 mm. long, after fruiting up to 18 mm. long; fruit globose, 10-11 mm. in diameter, the stigma plane-discoïd or almost capitate.

CHINA: Kiangsu: Nanking, *E. D. Merrill* 11371 (A). Honan: Ki-Kiang-shan, *A. N. Steward* 5239 (US), 9838 (A, US). Anhwei: Chu-wha-shan, *R. C. Ching* 2719 (A, LU); Liu-chu-wan, *R. C. Ching* 2736 (A, US); Chien-shan-hsien, *C. S. Fan & Y. Y. Li* 72 (A). Chekiang: Tung-yang-hsien, *Y. L. Keng* 912 (A). Hupei: Ichang, *A. Henry* 3292 (A, G, US); *E. H. Wilson* 3101 (A, SS); without precise locality, *F. B. Forbes* 854 (A).

Wilson 3101 is a mixture of staminate flowers and young fruits. The former have long pedicels, often with 3-flowered branches. The latter have short pedicels. In the Arnold Arboretum, I have numbered the latter 3101A.

Cultivated: I have seen specimens collected from La Mortola, Italy, by A. Rehder and also by C. Schneider; from United States National Botanic Gardens by P. Russell, and from Australia by J. F. Bailey.

Geographically, there is no clear demarcation between this variety and the typical *Ilex cornuta*. However, so far as is known, the variety has not been reported in those coastal areas beyond Long. 120°E. It commonly occurs in the hilly high lands on both sides of the Yangtze River from Kiangsu west to Hupei. The flowers appear in April and the fruit becomes red in November, persisting for a long time on the branches.

This variety differs from typical *Ilex cornuta* in having 3-flowered branches of the staminate inflorescences and longer fruiting pedicels (12-18 mm.). It was first collected by Fortune in Hwuy-chow, S. Anhwei.

His specimen was from an old plant with entire leaves. About it Lindley wrote, "In its young state it is much like *I. cornuta*, but in the adult condition it acquires quite another appearance, resembling a very broad-leaved entire-leaved European Holly . . . in the axil of each leaf a sessile umbel of from 6-10 stalks [of fruits] each about three-quarters of an inch long . . ." In S. Anhwei it was again collected by *R. C. Ching* (2719 with entire leaves only and 2736 with both entire and spinose leaves). Merrill's specimen from Purple Mountain in Nanking and Henry's and Wilson's specimens from western Hupei both possess spinose leaves only. It is obvious that in nature leaf dimorphism is as common in this long-pedicellate variety as in the typical *Ilex cornuta*.

SERIES 2. DIPYRENAE, SER. NOV.

Arbor vel frutex, ramulis puberulis; foliis coriaceis, rigidis, juvenilibus spinosis, in maturitate interdum partim integris; inflorescentiis paucifasciculatis, fasciculis 1-5-floris; fructus pedicellis 1-3 mm. longis; fructibus ellipsoideis vel depresso-globosis, saepe in paribus; pyrenis 1-4, plerumque 2, palmatim striatis et sulcatis, endocarpio crasso, lignescente.

KEY TO THE SPECIES

- A. Trees; leaves comparatively large, 6-9 cm. long, often entire; petioles 4-5 mm. long. (India-Yunnan).....40. *I. dipyrena*.
- AA. Shrubs; leaves 2-4.5 cm. long; petioles less than 3 mm. long.
 - B. Pyrenes 4; leaves ovate.
 - C. Leaves 3-4.8 cm. long, the margin sinuate, with 3-7 spines on each side; pyrenes suborbicular in outline, 4.5 mm. wide, broadly grooved on the dorsal surface. (Chekiang).....41. *I. wenchowensis*.
 - CC. Leaves 1.3-2.5, rarely up to 3 cm. long, the margin with 1 or 2, rarely 3 spines; pyrenes obovate or oblong, less than 4 mm. wide, impressed only at the broader end. (West and northwest China).....42. *I. pernyi*.
- BB. Pyrenes usually 2, rarely 1; leaves lanceolate, elliptic, rhomboid, quadrangular, rarely ovate, usually over 4 cm. long (except *I. perryana*).
 - C. Leaves lanceolate, with numerous spines; fruit obovoid-ellipsoid, 5-6 mm. in diameter. (Yunnan).....43. *I. georgei*.
 - CC. Leaves elliptic, rhomboid, or quadrangular, rarely ovate; fruit ellipsoid or subglobose, 8-10 mm. in diameter.
 - D. Erect shrubs over 1 m. high; leaves elliptic or ovate, truncate or rounded at the base, acuminate at the apex; the veinlets indistinct above; pyrenes 2, palmately striate and sulcate.
 - E. Leaves elliptic or ovate; margin with 4-6 weak spines on each side; pedicels of fruits pubescent. (Szechuan).....44. *I. ciliospinosa*.
 - EE. Leaves ovate or quadrangular, margin with 2-3 strong spines on each side; pedicels of fruits glabrous. (Yunnan to Taiwan).....45. *I. bioritsensis*.

DD. Prostrate shrubs less than 30 cm. high; leaves sub-rhomboid, rugose, obtuse at the base, broadly deltoid and acute at the apex, the upper surface with deeply impressed veinlets; pyrene 1, palmately striate and esulcate. (Yunnan, high altitude).....46. *I. perryana*.

40. *Ilex dipyrena* Wall. in Roxb. Fl. Ind. ed. Carey, 1: 473. 1820; D. Don, Prod. Fl. Nep. 188. 1825; Wall. List, 4327. 1830, et Pl. As. Rar. 3: pl. 292. 1832; Walp. Rep. 1: 540. 1842; Loud. Encyc. Pl. Suppl. 2: 1302. 1855; Brandis, For. Flor. 76. 1874; Hook. f. Fl. Br. Ind. 1: 599. 1875; Franch. Pl. Delav. 127. 1889; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 276 (Monog. Aquif. 1: 276). 1901; Chung in Mem. Sci. Soc. China 1: 140. 1924; Hand.-Mzt. Symb. Sin. 7: 656. 1933; Comber in Notes Bot. Gard. Edinb. 18: 44. 1933; Chen, Ill. Man. Chin. Trees 659. 1937.

Ilex dipyrena var. *connexiva* W. W. Sm. in Notes Bot. Gard. Edinb. 10: 41. 1917; Comber op. cit. 61. 1933. *Syn. nov.*

Ilex dentonii Hort. ex Loud. l. c.

Ilex dipyrena var. *paucispinosa* Loes. op. cit. 89: 283. 1908; Comber op. cit. 18: 45. 1933. *Syn. nov.*

Ilex monopyrena Watt. ex Loes. op. cit. 275. 1901; Hu and Tang in Bull. Fan Mem. Inst. Biol. Bot. 9: 252. 1940. *Syn. nov.*

Ilex bioritsensis Hayata var. *integra* Comber op. cit. 43. 1933. *Syn. nov.*

A puberulent evergreen tree up to 14 m. high with coriaceous elliptic-oblong, rarely ovate or lanceolate, spinose (or entire with an apical spine) leaves, fasciculate inflorescences, globose or ellipsoid fruits, 1-4 pyrenes with thick woody palmately striate and sulcate endocarp.

Branchlets straight, stout; third year's growth 4-6 mm. in diameter, cinereous, minutely longitudinally rimulose, the lenticels lacking or obscure, the leaf-scars semi-orbicular, not elevated; current year's growth sub-angular, longitudinally striate rugose or smooth, minutely puberulent or glabrescent, cinereous or cinnamon, the terminal buds conic, acute, puberulent. Leaves occurring also on second year's growth, 5-20 mm. apart; stipules callose, broadly deltoid, sometimes obscure; petioles 4-6 mm. long, one-twentieth to one-thirteenth the length of the lamina, shallowly canaliculate above, puberulent; lamina thick-coriaceous, shiny above or opaque on both surfaces, olivaceous, brown or even yellow, elliptic-oblong or rarely ovate, 4-10 cm. long, 2-4 cm. wide; base rounded; apex shortly acuminate, the acumen 3-10 mm. long, terminated by a sharp spine 2 mm. long; margin entire or subentire with few spines or spinose with up to 14 spines on each side; midrib sulcate, puberulent or glabrescent above, elevated beneath; lateral nerves 7-9 pairs, impressed above, elevated beneath, the reticulation of the veinlets obscure. Inflorescences fasciculate, axillary on second year's growth, the individual branch of the fascicles uniflorous; the bracts ovate-lanceolate, long-ciliate, the outer ones cuspidate, the inner ones obtuse, the basal appendages subulate, flowers 2-4-merous. Staminate flowers: pedicels 2-3 mm. long, sparsely and minutely puberulent or glabrescent, with 2 sub-basal lanceolate acute

prophylla, 1.5 mm. long, which reach the calyx; the calyx patelliform, 3 mm. across, deeply lobed, the lobes membranous, ovate-deltoid, obtuse or subacute, sparsely ciliate; corolla rotate, 7 mm. across, the petals ovate, 3 mm. long, ciliate, one-fifth connate at the base; stamens 4, longer than the petals, the anthers oblong-ovoid, 0.75 mm. long; the rudimentary ovary subglobose-ovoid, 1.5 mm. in diameter, the apex truncate or obtuse. Pistillate flowers: pedicels 1–3 mm. long; calyx and corolla as in the staminate flowers; staminodes slightly shorter than the petals, the sterile anthers ovate; ovary ovoid, the stigma discoid, plane, distinctly lobed. Fruit red, globose, 6–9 mm. in diameter, appearing sessile, the persistent calyx explanate, quadrangular, the stigma 2–4-lobed, discoid. Pyrenes 1–4, often 2; when two, oblong-elliptic or subcircular in outline, dorso-ventrally compressed, the ends obtuse or rounded, the back convex, longitudinally and subpalmately striate and sulcate, 5–7 mm. long, 5 mm. wide, the ventral side also striate-sulcate; when four, oblong in outline, 3.5 mm. wide at the back; the endocarp thick and woody.

CHINA: Yunnan: Li-kiang, *R. C. Ching* 20243 (A), 21576 (A); *K. M. Feng* 3101 (A), 3179 (A); *J. F. Rock* 3427 (A, US); *C. Schneider* 2845 (A); *T. T. Yu* 14921 (A); Hokin near Sung-kwei, *K. M. Feng* 6921 (A); western Yunnan, *G. Forrest* 10171 (A), 10224 (A), 10426 (A), 11071 (A), 12528 (TYPE of *Ilex dipyrena* var. *connexiva*, fragment in A), 19817 (A, US), 20096 (A, US), 20101 (A, US), 21023 (ISOTYPE of *I. bioritsensis* var. *integra*, A), 25362 (A); Cai-pou, *E. E. Maire* 125 (A); west of Ta-li, *J. F. Rock* 6781 (A, US); mountain of Londjre, *J. F. Rock* 8906 (A, US); Wei-hsi, *J. F. Rock* 11701 (A, US); locality not given, *H. T. Tsai* 57186 (A), 57360 (A), 57339 (A); Wei-si, *C. W. Wang* 67917 (A), 70400 (A); Atungtze, *T. T. Yu* 5773 (A), 7826 (A), 7831 (A), 8486 (A), 10610 (A), 11171 (A). Sikang: Zayul, *Kingdon Ward* 10990 (B).

INDIA: East Himalaya, *Griffith* 2011 (NY); Simlah, *Griffith* (NY); Chakrata, *M. A. Hamid* (NY); Ramilchet, *G. Kasilingarn* (NY); Punjab, *W. Koelz* 1990 (NY); Chamba, *W. Koelz* 8857 (NY); Mussoorie, *R. R. Steward* 14895 (NY); Kumson, *R. Strachey & J. E. Winterbottom* 3 (G); Wallich 4327 (TYPE, fragments in A).

UPPER BURMA: *F. K. Ward* 342 (NY).

CULTIVATED: Many specimens from botanical gardens of America and Europe have been examined.

Ilex dipyrena was first described from Nepal, where it is called "caulah." According to Wallich, it "blossoms from April to July." Now, as our knowledge of the flora of southwestern China has increased, we know that it is a common and wide-spreading species in Yunnan Province, where it grows as a tree (sometimes as a shrub, after cutting by fuel-gatherers) in mixed forests, in ravines, or on slopes of mountains at an altitude of 2000–3000 m. The fruit is greenish yellow in October and red in December.

As Wallich remarked, "This species varies considerably in the shape and serratures of the leaves. Generally they are oblong and remotely serrate; sometimes, however, they are of a more ovate form, rounded at the base, the margins sinuated and marked with pretty strong unequal

spinous serratures." This statement is true; varieties based on differences in leaf margin are not worthy of taxonomic recognition. *Rock 11701* serves as a good example. On that sheet, there are subentire leaves which resemble *Ilex dipyrena* var. *connexiva*, less spinose leaves which resemble *Ilex dipyrena* var. *paucispinosa*, and very spinose leaves. In specimens collected from Yunnan, the pyrenes vary from one to four. In the double-pyrened fruits there are often one or two small globose masses of stone-cells which may indicate aborted pyrenes. The fruits of *H. T. Tsai 57360* contain three or four pyrenes. Yet its vegetative characters show it to be an example of *Ilex dipyrena*.

41. *Ilex wenchowensis*, sp. nov.

Frutex parvus; ramulis pubescentibus, foliis spinosis, coriaceis, ovatis, 3–4.8 cm. longis, 1.2–2.5 cm. latis; petiolo 1–2 mm. longo; costa supra impressa et puberulente; nervis lateralibus utrinque 4 vel 5, supra evidentibus, subtus obscuris; inflorescentiis fasciculatis, unifloribus; pedicellis 1 mm. longis, prophyllis ciliatis; calycibus 4-lobis, ciliatis; corolla rotata, 6–7 mm. diametro, petalis oblongis, 3 mm. longis, 2.5 mm. latis, ciliatis, one-fifth connatis; staminibus 4, quam petalos aequilongis; ovario abortu turbinato, 1 mm. longo, apice obtuso; fructibus depresso-globosis, 5–6 mm. longis, 8 mm. diametro, calycibus 2.5 mm. diametro donatis; stigmate umbilicato vel discoideo; pyrenis 4, suborbicularibus, 5 mm. longis, 4.5 mm. latis, dorso palmatim striatis et depresso, lateralibus striatis et sulcatis.

An evergreen shrub up to 2 mm. high with pubescent branchlets, spinose ovate leaves, fasciculate inflorescences, depressed globose fruits and 4 palmately striate and dorsally depressed pyrenes.

Branchlets pubescent, castaneous; third year's growth 3.5 mm. in diameter, the lenticels lacking, the leaf-scars suborbicular, not elevated; current year's growth 3 mm. in diameter, angular and pubescent, the terminal buds narrowly conic, pubescent, unfolding after anthesis. Leaves occurring even on the third year's growth, 5–10 mm. apart; stipules minute, obscure; petioles 2 mm. long, one-twenty-fifth to one-eighteenth the length of the lamina, puberulous; lamina coriaceous, olivaceous, slightly shiny above, ovate, 3–4.8 cm. long, 1.2–2.5 cm. wide, truncate or rounded at the base, acuminate and spinose at the apex; margin sinuate, with 3–7 spines on each side, the midrib slightly impressed and pubescent above, slightly elevated beneath, the lateral nerves 4–5 pairs, evident above, obscure below. Inflorescence fasciculate, axillary on second year's growth, the individual branches of the fascicles all uniflorous; flowers all 4-merous. Staminate flowers: pedicels 1 mm. long, puberulous, with 2 large ciliate basal prophylla extending to the calyx; calyx patelliform, 2 mm. in diameter, deeply 4-lobed, the lobes deltoid, obtuse, ciliate; corolla rotate, 6–7 mm. across, the petals oblong, 3 mm. long, 2.5 mm. wide, sparsely ciliate, one-fifth connate at the base; stamens 4, equaling the petals in length, the anthers ovoid; rudimentary ovary conic, 1 mm. long, the apex obtuse. Pistillate flowers not seen. Infructescences fasciculate, the pedi-

cels 4–5 mm. long, puberulous, with 2 sub-basal ovate ciliate prophylla, the persistent calyx explanate, 2.5 mm. in diameter. Fruit (immature) depressed-globose, longitudinally grooved, 5–6 mm. long, 8 mm. in diameter, the stigma thin-discoïd or navel-like. Pyrenes 4, suborbicular in outline, 5 mm. long, 4.5 mm. wide, the dorsal surface palmately striate, esulcate and longitudinally depressed, the sides reticulately striate and sulcate, the endocarp woody.

CHINA: Chekiang: Wenchow, *R. C. Ching* 1819 (TYPE, A; US), 1820 (fruit, A; staminate flowers, US).

Ilex wenchowensis is localized in southeastern Chekiang, where it occurs on bushy slopes at an altitude of 600 m. There it flowers in May. It is closely related to *Ilex pernyi* Franch. which differs in having smaller leaves (1.3–2.5, rarely 3 mm. long) with one or two spines on each side and oblong or obovate pyrenes, impressed only at the broader ends. From *Ilex bioritsensis* Hayata it differs in having 4 pyrenes. From *Ilex centrochinensis* S. Y. Hu it differs in its very short petioles and median longitudinally impressed pyrenes.

42. *Ilex pernyi* Franch. in *Nouv. Arch. Mus. Hist. Nat.* II, 5: 221. 1883, *Pl. Dav.* 1: 69. 1884; Oliv. in *Hook. Ic. Pl.* III, 6: *pl.* 1539. 1886; Forbes & Hemsl. in *Jour. Linn. Soc. Bot.* 23: 117. 1886; Loes. ex Diels in *Bot. Jahrb.* 29: 436. 1900, in *Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur.* 78: 278 (Monog. Aquif. 1: 278). 1901, et in *Sarg. Pl. Wils.* 1: 78. 1911; Farrer in *Jour. Roy. Hort. Soc.* 42: 77. 1916; Chun, *Chin. Econ. Trees* 223. 1921; Chung, *Mem. Sci. Soc. China* 1: 141. 1924; Rehd. in *Jour. Arnold Arb.* 7: 199. 1926, 8: 156. 1927; Comber in *Notes Bot. Gard. Edinb.* 18: 75. 1933; Chen, *Ill. Man. Chin. Trees* 658, *fig.* 550. 1937; S. Y. Hu in *Ic. Pl. Omei.* 2: *pl.* 162. 1946.

An evergreen shrub or small tree up to 8 m. high with pubescent branchlets, very short petioles, small coriaceous ovate-lanceolate spinose leaves, fasciculate inflorescences, rather large globose drupes up to 8 mm. in diameter, and 4 palmately striate and sulcate pyrenes.

Branchlets straight, terete or subterete; third year's growth 4 mm. in diameter, apricot-colored, covered with a dirty gray pubescence, minutely rimulose, the lenticels lacking; second year's growth 3 mm. in diameter, dirty gray, densely pubescent; current year's growth 2 mm. in diameter, angular, pubescent, fulvous, the terminal buds ovoid-conic, acute, pubescent. Leaves occurring even on the fifth year's growth, crowded together, appearing sessile; stipules callose, deltoid, acute, 0.75 mm. long, 0.5 mm. wide; petioles very short, 2 mm. long, one-twelfth to one-eighth the length of the lamina, pubescent; lamina coriaceous, olivaceous, ovate or ovate-lanceolate, 1.3–2.5 cm., rarely 3 cm. long, 5–14 mm. wide, broadest between the two anterior spines; base rounded or truncate; apex triangularly acuminate, the acumen 12–14 mm. long, terminated by a strong spine 3 mm. long; margin sinuate-dentate, 1–3 spines (usually 2) on each side, the two anterior ones strongest; midrib slightly impressed above,

puberulent near the base, gradually becoming obscure toward the apex, elevated beneath, the lateral nerves 1-3 pairs, obscure beneath. Inflorescence fasciculate, axillary, on second year's growth; individual branches of the fascicles all uniflorous, the bracts lanceolate, membranous; pedicels sparsely puberulent, ciliate; flowers all 4-merous. Staminate inflorescence: pedicels 1 mm. long, glabrous, with 2 suborbicular ciliate super-median prophylla; the calyx 2 mm. across, deeply 4-lobed, the lobes broad-deltoid or semi-orbicular, ciliate; the corolla rotate, 7 mm. across, the petals 3 mm. long, broad-elliptic, the apical half ciliate; stamens slightly longer than the petals, the anthers 1 mm. long; the rudimentary ovary conic-ovoid, 1.5 mm. long, the apex obtuse. Pistillate inflorescence: pedicels 2 mm. long; calyx as in the staminate flowers; corolla choripetalous, erect, the petals ovate, 2.5 mm. long; the staminode two-thirds as long as the petals, the sterile anthers ovate; the ovary ovoid, the stigma discoid. Fruit globose or depressed-globose, 7-8 mm. in diameter, the persistent calyx quadrangular in outline, 2.5 mm. across, ciliate, the stigma thick-discoid, distinctly 4-lobed. Pyrenes 4, obovate or oblong in outline, 4.5-5.5 mm. long, 3-3.5 mm. wide, impressed on the back at the wider end, palmately striate and sulcate on the back, reticularly striate and sulcate along the sides, the endocarp thick, woody.

CHINA: Anhwei: Wu-yuan, *R. C. Ching* 3245 (A). Kiangsi: Hwang-lung-shan, *Y. K. Hsiung* 5627 (A). Hupei (Hupeh): Pa-tung-hsien, *H. C. Chow* 337 (A, NY); W. Hupei, *W. Y. Chun* 3808 (A), 4172 (A), 4153 (US); *A. Henry* 5298 (US), 5298A (A, NY); Ichang, *E. H. Wilson* 119 (staminate, A, US), 119A (fruit, A, US), 271 (A, NY, US). Kweichow: Perny (ex Franchet). Kansu: Feng-s'an-ling, *Farrer* 16. Shensi: Tsing-ling, *David*. Szechuan: Mt. Uo-mi San [Mt. Omei], *Fr. Hugh* in 1899 (B); Kwang-yun-hsien, *F. T. Wang* 22595. Sikang: Pau-hsien-hsien (Mu-pin), *K. L. Chu* 2456 (SS), 3090 (SS); Tien-chuan, *Y. S. Liu* 1313 (A).

CULTIVATED: I have seen cultivated specimens from the Royal Botanic Gardens at Kew, England, from J. A. Havemeyer, and from the Arnold Arboretum.

Ilex pernyi is endemic to the Tsing-ling Range, the climatic barrier in central China responsible for the very different aspects of the floras of North and South China. *Ilex pernyi* is found on both sides of this range, from Kansu down to the foothills of Hwang-shan in Anhwei. On the western limit of its area of distribution, the plant, as Farrer reported, grows as an "ugly and graceless little dumpy shrub . . . woodland of the drier ranges." On the eastern and southern sections of its area of distribution it is a shrub or small tree in forests growing at an altitude of 1800 m. (ex Chun). It flowers in April and May, and the fruit becomes red in October.

On the field notes attached to the specimen labeled *W. Y. Chun* 4172, the collector is erroneously recorded as "*R. C. Ching*."

The fruits of *Y. S. Liu* 1313 contain either two or three pyrenes. This may indicate that the two-pyrened *Ilex bioritsensis* Hayata is nothing

but a variety of *Ilex pernyi*. The small ovate-lanceolate shiny leaves and the palmately striate-sulcate, thickly woody endocarp of *Ilex pernyi* closely relate it to *Ilex georgei* Comber, which differs in having only two pyrenes.

43. *Ilex georgei* Comber in Notes Bot. Gard. Edinb. 18: 50. 1933; Hand.-Mzt. Symb. Sin. 7: 656. 1933; Merr. in Brittonia 4: 100. 1941.

Ilex pernyi Franch. var. *manipurensis* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 279 (Monog. Aquif. 1: 279). 1901.

Ilex pernyi sensu Loes. in Sarg. Pl. Wils. 1: 78. 1911, in part.

A spinose-leaved evergreen shrub up to 6 m. high with pubescent branchlets, lanceolate (rarely ovate) leaves, fasciculate inflorescences, obovoid-ellipsoid red fruits each with 1 or 2 pyrenes.

Branchlets rather stout, pubescent, cinereous or light brown; third year's growth 4 mm. in diameter, hirsute, the lenticels lacking; second year's growth 3.5 mm. in diameter; current year's growth subterete, 2-2.5 mm. in diameter, longitudinally shallowly striate-sulcate, densely pubescent, the terminal bud conic, pubescent. Leaves occurring even on the fourth year's growth, 2-5 mm. apart; stipules broadly ovate, acute; petioles 1-2 mm. long, one-twentieth to one-fifteenth the length of the lamina, pubescent, often covered by the decurrent base of the leaf; lamina thickly coriaceous, olivaceous, shiny above, opaque beneath, lanceolate, ovate-lanceolate or rarely ovate, 2-4.5 mm. long, 7-15 mm. wide; rounded or cordate at the base; acuminate at the apex, the acumen 10 mm. long, terminating in a spine 3 mm. long; margin thickened, recurved, subentire, with 4-7 spines on each side; midrib pubescent, shallowly impressed above, elevated beneath, the lateral nerves 5-7 on each side, indistinct above, evident beneath, the reticulation of the veinlets obscure on both surfaces. Inflorescences fasciculate, axillary on second year's growth. Staminate inflorescences: individual branches of the fascicles 1-3-flowered, the uniflorous pedicels 2-4 mm. long, when 3-flowered the peduncles 1 mm. long, both sparsely and minutely pubescent, the bracts membranous, ovate, obtuse, ciliate, the prophylla 2, membranous, submedian, pubescent; flowers 4-merous, calyx 1.5-2 mm. across, 4-lobed, lobes ovate, obtuse or rounded, ciliate; corolla rotate, 4-5 mm. across, the petals 2 mm. long, minutely and sparsely ciliate, one-tenth connate at the base; stamens longer than the petals, the anthers oblong; rudimentary ovary subglobose or ovoid, obtuse at the apex, sometimes obscurely 2-lobed. Pistillate flowers not seen. Fruit usually paired, obovoid-ellipsoid, 4-6 mm. long, 3-4 mm. thick, the pedicels 2 mm. long, pubescent, the persistent calyx ciliate, the stigma discoid. Pyrenes 1 or 2, obovoid-oblong, rarely suborbicular in outline, slightly dorso-ventrally compressed, flattened on one side, 4.5 mm. long, 2.5-3 mm. wide, longitudinally (almost palmately) 7-9-striate and shallowly sulcate on the back, the ends obtuse, the endocarp thickly woody.

CHINA: Yunnan: Tengyueh, *G. Forrest* 7577 (A), 9608 (A), 9712 (A), 16061 (fruit, ISOTYPE, A), 26251 (staminate flowers, ISOTYPE, A), 26254

(US); *J. F. Rock* 7677 (A, NY, US); San-ying-pa, *C. Schneider* 394 (A); without precise locality, *H. T. Tsai* 57247 (A); Mien-ning, *T. T. Yu* 17967 (A). S i k a n g : Ta-chien-lu, *E. H. Wilson* 119B (A).

NORTH BURMA: *F. K. Ward* 463 (A, NY).

Ilex georgei is confined to western and southwestern Yunnan and adjacent Burma, where it grows as a shrub in dense thickets, on dry slopes, or in side valleys at altitudes of 1800–2700 m. Its greenish staminate flowers appear in late March and on into May, and the fruit becomes red in October.

E. H. Wilson 119 is a mixture of material collected in Hupei and Sikang. The Hupei material has 4 pyrenes, while the Sikang (Ta-chien-lu) material has a much prolonged leaf-apex, as well as smaller fruits maturing only 2 pyrenes each. I have distinguished this latter material in the Arnold Arboretum herbarium as 119B.

The indumentum and the lack of uniformity in the number of pyrenes of *Ilex georgei* closely relates it to *Ilex ciliospinosa* Loes., but in the latter the leaves are less coriaceous and ovate or ovate-elliptic in shape, with a less prominent apex. The fruit is larger (8–10 mm. long), as are the pyrenes.

44. *Ilex ciliospinosa* Loes. in Sarg. Pl. Wils. 1: 78. 1911; S. Y. Hu in Ic. Pl. Omei. 2: pl. 161. 1946.

Ilex bioritsensis Hayata var. *ciliospinosa* (Loes.) Comber in Notes Bot. Gard. Edinb. 18: 43. 1933.

An evergreen shrub or small tree up to 7 m. high, with densely pubescent branchlets, elliptic or ovate-elliptic weakly spinose leaves, fasciculate inflorescences, ellipsoid drupes 8 mm. long, and 1–3 palmately striate and sulcate pyrenes.

Branchlets terete, dirty-gray, pubescent; fourth year's growth 4 mm. in diameter, reticulately rimulose, pubescent, the lenticels lacking, the leaf-scars broadly deltoid; second year's growth 3 mm. in diameter, densely pubescent, rugose; current year's growth subterete, longitudinally striate, light brown, densely pubescent, the terminal buds ovoid, pubescent, the apex cuspidate. Leaves occurring even on the fourth year's growth, 2–8 mm. apart; stipules callose, often tricuspidate; petioles 2–3 mm. long, one-fifteenth to one-tenth the length of the lamina, pubescent and rugose; lamina coriaceous, olivaceous, elliptic or ovate-elliptic, 2.5–4.5 cm. long, 1–2.5 cm. wide; round or rarely obtuse at the base; shortly acuminate or acute at the apex, the acumen 3–5 mm. long, terminating in a weak spine; margin serrate, with 4–6 spines on each side; midrib impressed and pubescent above, elevated and glabrous beneath, the lateral nerves 4–6 on each side, indistinct above, evident beneath, arching upward, near the margin reticulate. Inflorescences paucifasciculate, fascicles 2–5-flowered, axillary on last year's growth, the bud-scales persistent, ovate, acute, sparsely pubescent, ciliate, the bracts lanceolate, ciliate; the prophylla 2, median or submedian, not reaching the calyx, individual branches of the fascicles all uniflorous, the pedicels 2–3.5 mm. long, pubescent or glabres-

cent; flowers 4-merous. Staminate flowers: calyx 3 mm. broad, deeply lobed, the lobes ovate, deltoid, ciliate, obtuse or rounded at the apex; corolla rotate, 6 mm. broad, the petals ovate, 3 mm. long, 2 mm. wide, minutely ciliate at the apex, one-eighth connate at the base; stamens longer than the petals, the anthers oblong; rudimentary ovary ovoid, 1 mm. in diameter, the apical end indistinctly sulcate. Pistillate flowers: calyx as in the staminate flowers; corolla erect, choripetalous, 2.5 mm. long; staminodes about equaling the petals in length, the sterile anthers sagittate; ovary oblong, 2 mm. in diameter, truncate at the apex, the stigma discoid. Fruit solitary or paired, seldom 3 in a fascicle, ellipsoid, 8 mm. long, the pedicels 2-4 mm. long, pubescent or glabrescent, the persistent calyx 2-3 mm. across, quadrangular in outline, ciliate; the stigma thinly discoid. Pyrenes 1-3; obovoid in outline, palmately striate and sulcate, when 1, suggestive of a wheat-grain with a narrow shallow groove on the ventral side, when 2, (developing) dorso-ventrally compressed, slightly convex on the back, flat on the ventral side, when 3, obovoid, 6 mm. long, 4 mm. wide, the endocarp thick-woody.

CHINA: Szechuan: Mt. Omei, *W. C. Cheng* 6591 (Sz); *C. Y. Chiao & C. S. Fan* 871 (A); *W. P. Fang* 14800 (Sz); *Y. S. Liu* 1447 (A); *T. H. Tu* 720 (SS); *E. H. Wilson* 3316 (A); Opien-hsien, *W. C. Cheng* 6216 (Sz), 6456 (Sz); *S. N. Hsu* 69 (Sz); *C. Y. Yao* 2808 (SS), 4279 (SS), *Y. S. Liu* 2058 (A); *T. T. Yu* 639 (A), 663 (A), 835 (A); Chien-shi-hsien, *E. H. Wilson* 996 (ISOTYPE, A), Wa-shan, *E. H. Wilson* 996A (A); locality not clear, *E. H. Wilson* 3319 (A). Yunnan: Mengtze, *A. Henry* 11169 (A).

CULTIVATED: I have seen a specimen from Upper Bank Nurseries, located at Media, Pennsylvania.

Ilex ciliospinosa is endemic to western Szechuan, where it grows as a shrub or small tree in bamboo forests or in thickets at an altitude of 1700-2300 m. The greenish flowers appear in early May, and the fruit becomes red in September.

Comber, presuming that Wilson's specimens were juvenile forms, reduced *Ilex ciliospinosa* to a variety of *Ilex bioritsensis* Hayata. But Wilson's specimens were not juvenile forms, since most of the branchlets show plainly five years of growth. The leaves on the four-years' growth are the same in shape, texture, and margin as those on the current year's twigs. Furthermore, the specimen *T. T. Yu* 663 was collected from a tree 20 feet high. The spines of the leaves of this specimen are as weak as those on a 5-foot shrub. In this spinose group of *Ilex*, the "species" show much intergradation in the size and dentation of the leaves, in the indumentum, and in the number of pyrenes. Hence the reduction of any of them to varieties would result, consistently, in further reductions. Probably all would end up as varieties of *Ilex dipyrena* Wall., the oldest binomial of the group. Morphologically there is just as much resemblance and just as much difference between *Ilex ciliospinosa* Loes. and *Ilex bioritsensis* Hayata as between *Ilex bioritsensis* and *Ilex dipyrena*. Until cytological and genetic techniques can be applied to this group, it is better to keep all the members in specific rank.

In its weak and more numerous spines and in the inconsistent number of its pyrenes (1-3), *Ilex ciliospinosa* is very closely related to *Ilex dipyrena*, which differs in having large (6-10 cm. long) leaves and glabrescent branchlets.

45. *Ilex bioritsensis* Hayata in Jour. Coll. Sci. Tokyo 30: 53. 1911; Comber in Notes Bot. Gard. Edinb. 18: 42. 1933; Kanehira, Formosan Trees 371, fig. 325. 1936.

Ilex veitchii Veitch, New Hard. Pl. W. China 4, 1912, nomen subnudum; Anon. in Gard. Chron. III. 52: 289. 1912.

Ilex pernyi Franch. var. *veitchii* Bean, Trees Shrubs Hardy Brit. Isles 1: 650. 1914, nomen nudum; Rehd. in Mitteil. Deutsch. Dendr. Ges. 23: 263. 1914, descr.

Ilex diplosperma S. Y. Hu in Ic. Pl. Omei. 2: pl. 163. 1946.

An evergreen shrub or small tree up to 10 m. high, with glabrescent or sparsely puberulent branchlets, ovate or quadrangular strongly spinose leaves, fasciculate inflorescences, large fruits (8-10 mm. in diameter) and two dorso-ventrally compressed, palmately striate and sulcate, thick-woody pyrenes.

Branchlets glabrescent or sparsely puberulent; third year's growth subterete, cinereous, 3-4 mm. in diameter, smooth, the lenticels lacking; second year's growth 2.5 mm. in diameter, longitudinally striate rugose; current year's growth 2 mm. in diameter, striate and ridged, the terminal buds puberulent, conic, acute at the apex, the scales ciliate. Leaves occurring even on the fourth year's growth, 5-15 mm. apart; stipules callose, ovate, 0.8 mm. long, acute, constricted near the base; petioles 3 mm. long, one-fifteenth to one-twelfth the length of the lamina, pubescent; lamina thick-coriaceous, olivaceous or ochraceous, shiny above, opaque beneath, ovate-quadrangular, 2.5-6 cm. long (usually 3 cm. long), 1.5-3.5 cm. (usually 2 cm.) wide; base rounded or truncate; apex acuminate, the acumen 5-15 mm. long, terminated by a spine 3 mm. long; margin sinuate, with 3 or 4 strong spines on each side; midrib sulcate above, puberulent, elevated beneath, the lateral nerves 4-6 pairs, evidently impressed above, obscure or slightly elevated beneath; reticulation of the veinlets obscure on both surfaces. Inflorescences fasciculate, axillary on the second year's growth, the individual branches of the fascicles all uniflorous, the bracts ovate, ciliate, 1.75 mm. long; flowers 2-4-merous. Staminate flowers: pedicels 2 mm. long, glabrous, with 2 large ovate ciliate prophylla extending to the calyx; the calyx patelliform, 3 mm. across, the lobes broadly deltoid, obtuse, sparsely ciliate; corolla rotate, the petals broad-elliptic, 3 mm. long, one-eighth connate at the base; stamens longer than the petals, the anthers oblong; rudimentary ovary ovoid, 1 mm. in diameter. Pistillate flowers: pedicels 2 mm. long, glabrous, with 2 basal prophylla; calyx as in the staminate flowers; corolla choripetalous; staminodes half the length of the petals, the sterile anthers cordate; ovary oblong-ovoid, 2-3 mm. long, the stigma thin-discoid. Fruit ellipsoid, 8-10 mm. long; the stigma discoid. Pyrenes 2, dorso-ventrally compressed, ovate or sub-

orbicular in outline, 5–6 mm. long, 4–5 mm. wide, palmately 8–10-striate and sulcate on the dorsal surface, 5-striate on the ventral surface, the endocarp woody.

CHINA: Kweichow: Fan-ching-san, *Steward, Chiao & Cheo* 390 (A, US), 774 (A, NY, US); *P. C. Tsoong* 1041 (SS); Yin-kiang, *Y. Tsiang* 7736 (NY), 7965 (NY). Szechuan: Nan-chuan-hsien, *W. T. Fang* 640 (SS), 976 (A, SS); Mt. Omei, *W. P. Fang* 3097 (A, NY), 12879 (A, Sz, US), 16431 (Sz); O-pien-hsien, *T. S. Chao* 604 (SS); Muli, *J. F. Rock* 5211 (A, US), 17368 (A, US); Ning-yuan-fu, *C. Schneider* 942 (A); Lang-pa (Lolo-lang), *C. Schneider* 1070 (A), 1523 (A); Wu-shan, *E. H. Wilson* 1028 (A, NY, US); Yung-ching-hsien, Wa-wu-shan, *C. W. Yao* 2224 (SS); without precise locality, *H. C. Chow* 10005 (Sz). Yunnan: Li-kiang, *K. M. Feng* 622 (A); Chung-tien, *K. M. Feng* 966 (A); Yung-ning, *G. Forrest* 20644 (US); Che-kia, *E. E. Maire* 525 (A); Ho-kia-keou, *E. Maire* 3330 (NY, US); Yi-liang-hsien, *H. T. Tsai* 52130 (A); without precise locality, *T. T. Yu* 5446 (A). Taiwan: *N. Fukuyama & T. Suzuki* 15207 (TU); *E. Matuda* 1208 (TU); *R. Kanehira & S. Sasaki* 21807 (US); *E. H. Wilson* 10058 (A, US).

CULTIVATED: I have seen sterile specimens of juvenile plants from Kew and the Arnold Arboretum under the name *Ilex pernyi* var. *veitchii* Rehd.

This plant was first recorded from Bioritsu, Taiwan. Additional material has been collected from Kweichow, Szechuan, and Yunnan. Both on the Island and on the mainland it grows in forests as a small tree up to 10 m. high. It flowers in late April.

All the spinose-leaved *Ilex* characterized by medium-sized leaves with rather strong spines and two-pyrened fruits have been placed under this species. There is great variation in its leaf-form and indumentum. The stems of some specimens are almost glabrous, but others are as pubescent as those of *Ilex pernyi* Franch.

46. *Ilex perryana*, sp. nov.

Ilex pernyi sensu Marquand in Jour. Linn. Soc. Bot. 48: 168. 1929; sensu F. K. Ward in Gard. Chron. III, 92: 232. 1932, non Franch.

Ilex pernyi Franch. forma, Anon. in Notes Bot. Gard. Edinb. 17: 270. 1930.

Ilex pernyi Franch. var., Anon. in Notes Bot. Gard. Edinb. 17: 304. 1930.

Ilex georgei Comber var. *rugosa* Comber in Notes Bot. Gard. Edinb. 18: 51. 1933; Merrill in Brittonia 4: 100. 1941.

Frutex prostratus; ramulis brevissime pubescentibus; foliis spinosis, crasse coriaceis, supra nitidis et rugosis, subrhomboideis, raro ellipticis, 1–3 cm. longis, 7–15 mm. latis, basi obtusis, raro rotundatis, costa supra impressa, subtus obscura; inflorescentiis paucifasciculatis, axillaribus; ♂ unifloribus, pedicellis 2–3.5 mm. longis, calycibus ciliatis, corolla rotata, petalis 1.5 mm. longis, eciliatis, staminibus quam petalis aequilongis vel longioribus; ♀ unifloribus, pedicellis 3–4 mm. longis, ovario ovoideo, 1.5 mm. longo; fructibus subgloboso-ellipsoideis, 6–7 mm. diametro; pyrena 1, subglobosa, dorso-ventraliter compressa, 5 mm. diametro, dorso

palmatim striata et esulcata, ventro canaliculato, endocarpio lignescente.

A prostrate evergreen spinose shrub 20–30 cm. high with stout puberulent branchlets, small hexangularly subrhomboid rugose leaves, paucifasciculate inflorescences, small subglobose fruits, and a single palmately striate esulcate subglobose pyrene in each fruit.

Branchlets stout, straight, tuberculate with elevated leaf-scars, normal annual growth 2–3 mm. long, the third year's growth and the current year's growth almost alike in thickness and texture, 3–4 mm. in diameter, minutely puberulent, the lenticels lacking, the terminal buds ovoid, puberulent, well protected by crowded leaves or petioles. Leaves occurring even on sixth year's growth, 2–3 mm. apart; stipules callose, ovate, ca. 0.6 mm. long, acute, slightly constricted at the base; petioles 1–2 mm. long, one-fifteenth to one-tenth as long as the lamina, glabrous or minutely puberulent, dorso-ventrally flattened; lamina thick-coriaceous, olivaceous or brunneous-olivaceous, very shiny and rugose above, opaque and smooth beneath, hexangular-subrhomboid, rarely elliptic, 1–3 cm. long, 7–15 mm. wide; obtuse, rarely rounded at the base; broadly deltoid at the apex, the tip acute, terminated by a spine 2 mm. long; margin subentire-sinuate, with 2 or 3 spines on each side; midrib deeply impressed above, glabrous, slightly elevated beneath, the lateral nerves 3 or 4 pairs, deeply impressed above, obscure beneath, the reticulation of the veinlets impressed above, inconspicuous beneath. Inflorescence paucifasciculate, axillary on second year's growth; fascicles with 2–4 flowers, the bud-scales persistent, cartilaginous, suborbicular, glabrescent; flowers all 4-merous. Staminate inflorescences: individual branches of the fascicles uniflorous, the bracts ovate, obtuse, sparsely puberulent, ciliate; pedicels 2–3.5 mm. long, glabrous, with 2 submedian or basal glabrous ciliate prophylla; calyx patelliform, 3 mm. across, deeply 4-lobed, lobes ovate, 0.9 mm. long, 0.75 mm. wide at the base, glabrous, minutely ciliate; corolla rotate, 4–5 mm. across, the petals ovate, 1.5 mm. long, eciliate, one-sixth connate at the base; stamens equaling or slightly longer than the petals, the anthers ovoid-oblong, 0.75 mm. long; rudimentary ovary pulvinate, obscurely lobed. Pistillate inflorescences: individual branches of the fascicles uniflorous, the calyx and corolla as in the staminate; ovary ovoid, 1.5 mm. long, constricted below the discoid stigma. Fruit subglobose-ellipsoid, 6–7 mm. in diameter, the fruiting pedicels 3–4 mm. long, the stigma discoid, orbicular. Pyrene 1, subglobose, slightly dorso-ventrally compressed, 5 mm. in diameter, palmately striate and esulcate on the back, canaliculate on the ventral side, the endocarp thickly woody.

CHINA: Yunnan: *G. Forrest* 17538 (A), 18006 (A); Newahlung, *T. T. Yu* 19330 (A); Barcuhiwang, *T. T. Yu* 20942 (TYPE, A).

NORTH BURMA: *F. K. Ward* 224 (A), 9873 (A).

Ilex perryana is a prostrate dwarf shrub confined to the alpine flora of eastern Himalaya, where it grows on open rocky slopes at altitudes of 3000–3650 m. The flowers appear in June and the fruit turns red in November.

In its small leaves, few spines, and subglobose pyrenes this alpine *Ilex* is closely related to *Ilex pernyi* Franch., which differs in having leaves with a smooth surface, prolonged apex, and truncate base, and fruits which are consistently 4-pyrened. It can easily be distinguished from all the other spinose species of *Ilex* by its prostrate habit, and its striate esulcate pyrenes.

The descriptions of the staminate and pistillate flowers were drawn respectively from *Ward 9873* and *Yu 19330*.

This species is named in honor of Dr. Lily M. Perry of the Arnold Arboretum, whose assistance and advice has been of great value.

SERIES 3. DENTICULATAE, SER. NOV.

Arbor vel frutex; foliis crasse coriaceis, raro subcoriaceis, crenulato-serratis, serratis vel raro integris; inflorescentiis fasciculatis, pseudopaniculatis vel pseudoracemosis; floribus 4-meris; corolla ♂ basi connata, ♀ choripetala; fructibus globosis, stigmate umbilicato; pyrenis rugosis et caveatibus, raro palmatim striatis; endocarpio lapidoso.

KEY TO THE SPECIES

- A. Ovary and fruit pubescent.
 - B. Fruiting pedicels ca. 4 mm. long; leaves elliptic or ovate-elliptic, 3–7 cm. long, 1.3–2.5 cm. wide, the lower surface pubescent; petioles 3–6 mm. long. (Hainan and Indo-China)...47. *I. pubilimba*.
 - BB. Fruiting pedicels ca. 8 mm. long; leaves oblong or oblong-elliptic, 10–15 cm. long, 4.5–7.5 cm. wide, the lower surface glabrous; petioles 20–22 mm. long. (Hainan).....48. *I. kaushue*.
- AA. Ovary and fruit glabrous.
 - B. Branchlets, leaves and inflorescences densely hirsute. (Kwangsi).....49. *I. nanningensis*.
 - BB. Branchlets and inflorescences glabrous, glabrescent or puberulous, the leaves always glabrous.
 - C. Leaves thick-coriaceous, 10–17 cm. long, 4.5–7.5 cm. wide; individual branchlets of the staminate inflorescences 3–9-flowered. (East China and Japan).....50. *I. latifolia*.
 - CC. Leaves coriaceous or subcoriaceous, rarely up to 10 cm. long; individual branchlets of the staminate inflorescence 1–3-flowered.
 - D. Leaves entire; fruits 5 mm. in diameter, smooth when dry. (Taiwan).....51. *I. susukii*.
 - DD. Leaves crenulate-serrulate, serrate or rarely subentire; fruits 6–15 mm. in diameter, when dry usually wrinkled.
 - E. Fruits 5–7 mm. in diameter; pyrenes 4–5 mm. long.
 - F. Leaves coriaceous, the apex obtuse or rarely abruptly and shortly acuminate; fruiting pedicels 4–8 mm. long.
 - G. Branchlets glabrous; margin of leaves densely and often irregularly serrate; infructescences pseudoracemose or fasciculate; fruiting pedicels 6–8 mm. long. (India and Southwest China).....52. *I. denticulata*.

- GG. Branchlets puberulous; margin of leaves remotely serrate; infructescences fasciculate, the fruiting pedicels ca. 4 mm. long. (Hong-kong and vicinity).....53. *I. graciliflora*.
- FF. Leaves subcoriaceous, the apex long-acuminate, the acumen 10–16 mm. long; fruiting pedicels 10–12 mm. long. (Kwangtung)..54. *I. tsangii*.
- EE. Fruit 10–15 mm. in diameter; pyrenes 7–12 mm. long.
- F. Mature fruit solitary; fruiting pedicels 2–4 mm. long; pyrenes obovate in outline, 10–12 mm. long. (Kwangsi).....55. *I. chingiana*.
- FF. Mature fruits fasciculate; fruiting pedicels 6–10 mm. long; pyrenes 7–9 mm. long.
- G. Leaves elliptic or obovate; reticulation of the veinlets prominent on both surfaces; pyrenes oblong in outline, both ends obtuse or one end emarginate. (Taiwan).....56. *I. uraiensis*.
- GG. Leaves oblong, ovate-elliptic or oblanceolate; reticulation of the veinlets obscure above; pyrenes broad-elliptic in outline, the ends pointed.
- H. Branchlets castaneous or nigrescent; leaves shiny above with caudate apex, the acumen 7–16 mm. long; the base obtuse or rounded. (South China).....57. *I. subfcoidea*.
- HH. Branchlets cinereous; leaves opaque on both surfaces, with acuminate apex, the acumen 5–10 mm. long; base cuneate. (Hainan).....58. *I. nuculicava*.

47. *Ilex pubilimba* Merr. & Chun in Sunyat. 5: 109. 1940.

Ilex hirsuticarpa Tardieu-Blot in Not. Syst. XII. 15: 120. 1945, et in Fl. Gén. Indo-Chine Suppl. 1: 776. 1948. *Syn. nov.*

A densely pubescent evergreen tree up to 15 m. high with coriaceous, elliptic, shortly acuminate, crenate-serrate leaves, fasciculate inflorescences, pubescent ovary, short fruiting pedicels (2–4 mm.), and depressed globose fruits 7 mm. in diameter.

Branchlets straight, subterete, fuscous when dry; third year's growth 4 mm. in diameter, pubescent, longitudinally rimulose, the lenticels obscure, the leaf-scars semi-orbicular; second year's growth pubescent; current year's growth 2–2.5 mm. in diameter, subterete, very densely pubescent, the indumentum fuscous; terminal buds small, naked, pubescent. Leaves occurring also on the second year's growth, 2–12 mm. apart; stipules callose, deltoid, pubescent at the base; petioles 3–6 mm. long, one-twentieth to one-twelfth the length of the lamina, densely pubescent, canaliculate above; lamina thick-coriaceous, when dry cinereous-olivaceous and shiny above, paler with over-all pubescence beneath, elliptic, rarely

ovate-elliptic or lanceolate, 3–7 cm. long, 1.3–2.5 cm. wide; base rounded, obtuse or cuneate; apex shortly acuminate, the acumen 3–10 mm. long, the tip obtuse; margin crenate-serrate, slightly recurved when dry; midrib impressed and pubescent above, elevated beneath, lateral nerves obscure. Inflorescence fasciculate, axillary, on last year's growth, short-pedicellate; bracts ovate to semi-orbicular, densely pubescent; flowers 4-merous. Staminate flowers: individual branches of the fascicles 1–3-flowered, 3-flowered branches cymose, the peduncle 0.5–1 mm. long, the pedicels 2–3 mm. long, with 2 basal prophylla; calyx patelliform, 1.5–2 mm. in diameter, rugose, 4-lobed, the lobes rounded, ciliate; corolla rotate, 6 mm. in diameter, the petals oblong, 2.5 mm. long, ciliate, one-ninth connate at the base; stamens slightly shorter than the petals, the anthers ovoid, 0.75 mm. long; rudimentary ovary conical, 1 mm. in diameter, the apex obtuse. Pistillate flowers: individual branches of the fascicles uniflorous, the calyx and corolla as in the staminate flowers; staminodes one-third the length of the petals, the sterile anthers ovate; ovary subglobose, 1.75 mm. in diameter, sparsely but distinctly pubescent, the stigma discoid, convex. Fruit depressed globose, 7 mm. in diameter, the fruiting pedicel 3–4 mm. long, pubescent, the persistent calyx explanate, orbicular in outline, 2 mm. across, shallowly 4-lobed, the lobes ciliate, the stigma thinly discoid, orbicular. Pyrenes 4, suborbicular or oblong in outline, 4–5 mm. long, 3.5–4 mm. wide, rugose, flattened or slightly impressed on the back, the endocarp woody.

CHINA: Hainan: Kan-en, S. K. Lau 5974 (A); Bak-sa, S. K. Lau 25742 (material for the description of the staminate flower) (A); S. K. Lau 26069 (material upon which description of the pistillate flower is drawn) (A); Yai-chow, H. Y. Liang 62579 (A, K, NY, US), 62624 (TYPE, A; K, NY, US); without precise locality, H. Y. Liang 63624 (A, NY); C. Wang 35188 (A, NY).

INDO-CHINA: Tonkin: W. T. Tsang 30339 (A); Annam: Poilane 8235 (A, ISOTYPE of *I. hirsuticarpa*).

Ilex pubilimba Merr. & Chun has been recorded from Hainan Island and Indo-China, where it grows as a big tree in mixed forests. The whitish yellow flowers appear in March.

The vegetative characters, especially the indumentum, and the leaf form of *Ilex pubilimba* are very similar to those of the very closely allied species *Ilex nanningensis* Hand.-Mzt. Professor Merrill has written on the type specimen and on other Hainan material "*Ilex nanningensis* Hand.-Mzt." On closer examination, however, these two species can easily be distinguished from each other by the size of their fruits, the length of the petioles and fruiting pedicels, and the indumentum of the ovary. In *Ilex nanningensis* the fruits are 10 mm. in diameter, the petioles one-tenth to one-sixth as long as the lamina, the fruiting pedicels 6–8 mm. long, and the ovary glabrous. In *Ilex pubilimba* the fruits are 7 mm. in diameter, the petioles one-twentieth to one-twelfth as long as the lamina, the fruiting pedicels 3–4 mm. long, and the ovary pubescent.

48. *Ilex kaushue*, sp. nov.

Arbor; ramulis pubescentibus; foliis oblongis vel oblongo-ellipticis, 10–15 cm. longis, 4.5–7.5 cm. latis, basi obtusis vel cuneatis, apice acutis vel breviter acuminatis, margine serratis vel biserratis; costa supra impressa pubescente, subtus elevata, nervis lateralibus 14 vel 15 paribus; inflorescentiis fasciculatis vel pseudoracemosis, pedicellis 8 mm. longis, pubescentibus; fructibus subglobosis, 11 mm. longis, 9–10 mm. diametro; pubescentibus; calycibus persistentibus ciliatis, stigmate umbilicato; pyrenis 4, ca. 7.5 mm. longis, 4.5–5 mm. latis, endocarpio lapidoso.

An evergreen tree with densely puberulent branchlets, large oblong thin-coriaceous serrate or double-serrate leaves, fasciculate infructescence, large subglobose puberulent fruits, and 4 reticulately striate sulcate wrinkled and pitted pyrenes.

Branchlets straight, subterete, brown, longitudinally ridged and canaliculate; second year's growth 4 mm. in diameter, the lenticels lacking, the leaf-scars deltoid-semi-orbicular; current year's growth angular, longitudinally plicate, 3.5 mm. in diameter; densely puberulent especially in the grooves; terminal buds acute-conic, pubescent. Leaves occurring also on second year's growth, 10–18 mm. apart; stipules callose, often hidden; petioles pubescent, slender, 20–22 mm. long, one-sixth to one-fifth the length of the lamina, subterete and angular, very narrowly canaliculate above; lamina thin-coriaceous, brunneous-olivaceous, shiny above, paler and opaque beneath; oblong or oblong-elliptic, 10–18 cm. long, 4.5–7.5 cm. wide; base obtuse or cuneate; apex acute or very shortly acuminate, the acumen 3–6 mm. long; margin serrate or double-serrate; midrib impressed, sparsely and minutely puberulent above, prominent, elevated and keeled beneath, the lateral nerves in 14 or 15 pairs, prominent on both surfaces; the reticulation of the veinlets dense and evident on both surfaces. Infructescences fasciculate or pseudoracemose, the rachis up to 9 mm. long, densely puberulent; bracts caducous, the lower persistent ones cartilaginous, broad-deltoid, obtuse, coarsely ciliate, the basal appendages acute, pubescent; pedicels 8 mm. long, pubescent; persistent calyx explanate, ca. 5 mm. across, puberulent, 4-lobed, the lobes broad-deltoid, very acute or cuspidate, sparsely ciliate. Fruit subglobose or ellipsoid, ca. 11 mm. long, 9–10 mm. in diameter, the exocarp densely puberulent, the stigma navel-like. Pyrenes 4, oblong in outline, ca. 7.5 mm. long, 4.5–5 mm. wide, reticulately striate and sulcate, wrinkled and pitted, the endocarp stony.

CHINA: Hainan: Taam-chau, *W. T. Tsang* 864 (LU 16363) (TYPE, A; LU, US).

This species is endemic to Hainan Island. The local name is "kau-shue." In September the fruits become yellow.

The large leaves, the pseudoracemose infructescences, and the wrinkled and pitted pyrenes of *Ilex kaushue* suggest a relationship with *Ilex latifolia* Thunb., but the latter has smaller glabrous fruits, glabrous branchlets, and thick-coriaceous leaves with no evident reticulations of the veinlets.

On the labels distributed by the Herbarium of Lingnan University, the notation "flowers yellow" is given. Since the specimens at hand show no evidence of the flowering stage, I assume that there may have been a mechanical error in the preparation of the labels. The color yellow as given undoubtedly refers to the fruit, since the specimen was collected in September.

49. *Ilex nanningensis* Hand.-Mzt. in *Sinensia* 5: 2. 1934; Chun in *Sunyat.* 4: 225. 1940.

A densely pubescent evergreen tree up to 20 m. high with coriaceous elliptic or lanceolate, shortly acuminate crenate-serrate leaves, fasciculate inflorescences, large subglobose fruits, 10 mm. in diameter, and long fruiting pedicels (8 mm. long).

Branchlets straight, fuscous when dry; third year's growth 4 mm. in diameter, pubescent, smooth, inconspicuously longitudinally rimulose, the lenticels lacking, the leaf-scars semi-orbicular; second year's growth densely pubescent; current year's growth subterete or angular, 2.5 mm. in diameter, fuscously and densely pubescent, the terminal buds naked, small, pubescent. Leaves occurring even on the fourth year's growth, 3-10, sometimes up to 15 mm. apart; stipules callose, deltoid, falcate, very acute, pubescent at the base; petioles 7-10 mm. long, one-tenth to one-sixth the length of the lamina, pubescent, the distal half narrowly winged by the decurrent leaf-base, canaliculate above; lamina thick-coriaceous, cinereous-olivaceous when dry, shiny above, dusty brown beneath, elliptic, very rarely lanceolate or ovate-elliptic, 5-8 cm. long, 1.5-3.5 cm. wide; obtuse or cuneate at the base; very shortly and gradually acuminate at the apex, the acumen broad-deltoid, 5-12 mm. long, often nigrescent; margin crenate-serrate, slightly recurvate when dry; midrib impressed and pubescent above, elevated beneath, the lateral nerves 7 or 8 pairs, obscure above, evident beneath, the reticulation of the veinlets sometimes evident beneath. Inflorescence fasciculate, axillary, on the second year's growth, fascicle 2-5-flowered, the bracts ovate-reniform, mucronate, or cuspidate, ciliate; flowers 4-merous. Pistillate flowers: individual branches of the fascicles uniflorous, the pedicels 6-8 mm. long, pubescent, with 2 submedian long-deltoid pubescent prophylla; calyx patelliform, 3 mm. across, the lobes shallow, rounded, 0.5 mm. long, 1.5 mm. wide, rugose, very sparsely and minutely puberulent, ciliate; corolla rotate, 8 mm. in diameter, the petals 3 mm. long, 2 mm. wide, the apical portion ciliate; staminodes slightly shorter than the petals, the sterile anthers sagittate; ovary large, ovoid, 3 mm. long, 2.5 mm. wide, the apical end truncate, the stigma discoid. Staminate flowers not seen. Fruit subglobose, 8 mm. long, 10 mm. in diameter, the stigma flat, orbicular, 2 mm. across, the persistent calyx explanate, orbicular, 3 mm. across, ciliate; the fruiting pedicels 8 mm. long, the exocarp thin, the mesocarp fleshy, abundant. Pyrenes 4, oblong in outline, 6.5 mm. long, 5.5 mm. wide, rugose, reticulately striate, flattened and broadly depressed on the dorsal surface, the endocarp woody.

CHINA: Kwangtung: Sin-fung, *Y. W. Taam* 271 (A). Kwangsi: Seh-feng-dar-shan, *R. C. Ching* 8082 (ISOTYPES LU, NY; fragments, A); Sup-man-ta-shan, *H. Y. Liang* 69851 (A); Shap-man-taai-shan, *W. T. Tsang* 22073 (A). Hainan: Ba-tung, *S. K. Lau* 28238 (A).

Ilex nanningensis was first described from a specimen collected in the high mountains south of Nanning, Kwangsi Province. From the material at hand, it appears to be endemic to the mountain range between Kwangsi and Indo-China. There it grows as a big tree in woods or mixed forests at an altitude of 600 m. The fragrant yellow flowers appear in April and the fruit turns bright red in October.

It should be noticed that the Kwangsi localities all refer to one mountain range, the name of which is variously transliterated by persons speaking different dialects. The preferred spelling is "Shih-wan-ta-shan."

The large fruit, the big rugose pyrenes, and the form and shape of the leaves of this species ally it closely to *Ilex subficoidea* S. Y. Hu, which differs in having glabrous branchlets and leaves.

50. *Ilex latifolia* Thunb., Fl. Jap. 79. 1784; Willd. Sp. Pl. 1(2): 708. 1797; Persoon Syst. Veg. 174, 1797, et Syn. Pl. 1: 151. 1805; Poir. in Lam. Encycl. Suppl. 3: 66. 1813; Roem. & Schult., Syst. 3: 488. 1818; DC. Prodr. 2: 16. 1825; Spreng. Syst. 1: 494. 1825; Dietr. Syn. Pl. 1: 556. 1839; Sieb. & Zucc. in Abh. Bay. Ak. Wiss. IV, 2: 148 (Fl. Jap.). 1845; Regel in Gartenfl. 13: 38. 1864; Hook. in Bot. Mag. 22: pl. 5597. 1866; Miq. in Ann. Mus. Bot. Lugd.-Bat. 3: 105. 1867; Maxim. in Mém. Acad. St. Pétersb. VII, 29(3): 29, 43, pl. 1, fig. 2. 1881; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 289 (Monog. Aquif. 1: 289). 1901; Moore, Holly Yew Box 127. 1908; Chung in Mem. Sci. Soc. China 1: 140. 1924; Chien in Contr. Biol. Lab. Sci. Soc. China 3(1): 58. 1927; Rehd. in Jour. Arnold Arb. 8: 157. 1927; Hand.-Mzt., Symb. Sin. 7: 656. 1933; Belval, Mus. Heud. Nat. Bot. Chin. 2: 21. 1933; Kia, Pl. Sin. Ill. 491, fig. 830. 1937; Chen, Ill. Man. China Trees 660, fig. 552. 1937.

Ilex macrophylla Blume Bijdr. 1150. 1825; Dietr., Syn. Pl. 1: 556. 1839; Walp. Rep. 1: 540. 1842.

Ilex tarajo Hort. Göpp. in Gartenfl. 3: 325. 1854.

Ilex terago Anon. in Gard. Chron. 1859: 508, 972. 1859.

A very large, entirely glabrous evergreen tree up to 20 m. high, trunk 60 cm. in diameter (ex Ching) with large thick-coriaceous oblong serrate leaves, axillary paniculate staminate and racemose pistillate inflorescences, globose fruit with thick exocarp, and 4 bony wrinkled pyrenes.

Branchlets straight, stout, ochraceous or brown; second year's growth 5–7 mm. in diameter, longitudinally plicate, often rimose, the lenticels lacking or sparse, the leaf-scars elevated, broad-deltoid or semi-orbicular; current year's growth 4–5 mm. in diameter, striate, sulcate and angular, smooth and glabrous, tuberculate under a lens. Leaves occurring even on the third year's growth, 8–17 mm. apart; stipules very minute and

callose, broad-deltoid, acute; petioles thick, short, rugose, 15–20 mm. long, one-eighth to one-seventh the length of the lamina, 3 mm. in diameter, subcylindrical, slightly impressed above, glabrous; lamina thick-coriaceous, olivaceous, shiny above, opaque beneath, oblong or ovate-oblong, 8–17 cm. long, 4.5–7.5 cm. wide; base rounded; apex obtuse or very shortly acuminate, the acumen 3–6 mm. long; margin serrate, the teeth nigrescent; midrib impressed above, strongly elevated beneath, the lateral nerves 15–17 pairs, obscure on both surfaces. Inflorescences pseudopaniculate, sessile, axillary, on the second year's growth; rachis 1–2 cm. long, 2–3 mm. thick, the bud scales persistent, imbricate, the outer ones cartilaginous, rounded, ca. 3 mm. long, 5 mm. wide, the inner ones membranous, larger; flowers 4-merous. Staminate inflorescence: individual branches of the pseudopanicles 3–9-flowered, cymose, the bracts ovate, 5–7 mm. long, 3–5 mm. wide, the peduncles 2 mm. long, the bracteoles hyaline, ovate or lanceolate, 2–3 mm. long, the pedicels 6–8 mm. long, with 1 or 2 sheath-like, broad-deltoid basal prophylla; calyx subcupuliform, 3.5 mm. in diameter, shallowly 4-lobed, the lobes rounded, ca. 0.75 mm. long, 1.75 mm. wide; corolla rotate, reflexed, ca. 9 mm. across, the petals ovate-oblong, ca. 3.5 mm. long, 2.5 mm. wide, one-eighth connate at the base; stamens equaling the petals in length, the anthers ovoid-oblong, ca. 1.25 mm. long, the filament twice as long; rudimentary ovary subglobose, ca. 1 mm. in diameter, the apex introrse, 4-lobed. Pistillate inflorescence: individual branches of the pseudopanicles 1–3-flowered, the peduncles of the 3-flowered cymes 2 mm. long, the pedicels of the uniflorous ones 5–8 mm. long, with 1 or 2 basal prophylla; calyx patelliform, ca. 3 mm. across; corolla erect, ca. 5 mm. across, the petals ovate, ca. 3 mm. long, 2 mm. wide; staminodes one-third the length of the petals, the sterile anthers minute, ovate; ovary ovoid, ca. 2 mm. wide at the base, the stigma 4-lobed discoid. Fruit globose, ca. 7 mm. in diameter, brown or reddish when dry, the stigma thinly discoid, explanate, the exocarp thick, smooth, minutely tuberculate under a lens, the persistent calyx explanate, 3–4 mm. across. Pyrenes 4, oblong-elliptic in outline, ca. 5 mm. long, 2.5 mm. wide, irregularly wrinkled and pitted, the dorsal surface with 3 distinct longitudinal ridges, the endocarps bony.

CHINA: Kiangsu: I-shing, *Ching & Tso* 630 (A); *K. Ling* 12377 (NY). Anhwei: Chu-wha-shan, *R. C. Ching* 2626 (A, LU); Chi-men, *R. C. Ching* 3155 (A); Wang-shan, *A. N. Steward* 7140 (A, US). Chekiang: Tien-tai-shan, *R. C. Ching* 1436 (A, US); Chen-chion, *R. C. Ching* 1780 (A, LU, US); Tien-mo-shan, *R. C. Ching* 5113 (A); Ning-po, *E. Faber* (NY). Fukien: *Dunn* 2474 (A).

JAPAN: Honshu, *R. K. Beattie & Y. Kurihara* 1014 (A); *U. Faurie* 6122 (A); Nagasaki, *Maximowicz* in 1863 (G, NY); Yokohama, *Maximowicz* in 1862 (NY); *K. Sakurai* in 1901 (A), in 1913 (A); Hondo, *K. Shiota* 7421 (A); *Siebold* (A); Mt. Kirishima, *E. H. Wilson* 6253 (A), 10340 (A); Tokyo, *E. H. Wilson* 6378 (A); *C. S. Sargent* (A); *K. Watanabe* in 1889 (G).

CULTIVATED: I have seen specimens from various botanical gardens of Europe and America.

Ilex latifolia was first recorded from Japan. Specimens have been collected from a few of the coastal provinces of China. It has been reported as common in central Chekiang Province. It grows in woods at an altitude of 100–700 m. and the flowers, which appear in April, are yellowish green. The fruits turn red in October.

In Chekiang and Fukien provinces the wood of this species is used for rolling-pins and other turned work. The bark is used for making bird-lime and the leaves are used as a substitute for tea.

The large thick glossy leaves of *Ilex latifolia* are very characteristic. There is no other species of Chinese *Ilex* that has the like. In the structure of the inflorescence and flowers it is closely related to *Ilex denticulata* (Wall.) Wight, which differs in having smaller leaves and fruits.

51. *Ilex suzukii*, sp. nov.

Frutex; ramulis glabris; foliis coriaceis, ellipticis, 2.5–4 cm. longis, 1.5–2.2 cm. latis, integris, basi acutis vel cuneatis, apice breviter acuminate vel obtusis, acuminibus 3 mm. longis, costa supra plana, subtus elevata, nervis lateralibus utrinque 5 vel 6, subtus prominentibus; inflorescentiis fructiferis paucifasciculatis, axillaribus, pedicellis 4 mm. longis, glabris; fructibus globosis, 5 mm. diametro, stigmate umbilicato, pyrenis 4, 3 mm. longis, 2 mm. latis, palmatim striatis, esulcatis, lignescentibus.

An evergreen shrub with glabrous branches, small elliptic entire leaves, fasciculate infructescences, globose fruit with a navel-like stigma and palmately striate, esulcate pyrenes.

Branchlets nigrescent, glabrous; third year's growth terete, 2.5 mm. in diameter, the lenticels lacking, the leaf-scars semi-orbicular, slightly elevated; current year's growth 1.5 mm. in diameter, longitudinally ridged, angular, the axillary buds large, globose, the terminal bud acute-conic, glabrous, the scales densely ciliate. Leaves occurring even on the fourth year's growth, 2–6 mm. apart; stipules very minute, often obscure; petioles 5–7 mm. long, one-eighth to one-fifth as long as the lamina, narrowly canaliculate above, glabrous; lamina coriaceous, brunneous-olivaceous when dry, somewhat shiny above, opaque beneath, elliptic, 2.5–4 cm. long, 1.5–2.2 cm. wide, acute or cuneate at the base, obtuse or very shortly acuminate at the apex, the acumen 3 mm. long; margin entire; midrib plane above, slightly elevated beneath, the lateral nerves 5 or 6 pairs, obscure above, prominent beneath, the reticulation of the veinlets obscure above, prominent beneath. Flowers not seen. Infructescences paucifasciculate, axillary, on the second year's growth, the fascicles with 2 or 3 fruits, the individual branches of the fascicles uniflorous, the bracts sub-orbicular or ovate, ciliate; fruiting pedicels 4 mm. long, glabrous, with 2 minute deltoid ciliate prophylla at the base. Fruit globose, 5 mm. in diameter, castaneous, smooth and shiny when dry, the persistent calyx explanate, orbicular in outline, 2.5 mm. in diameter, shallowly 4-lobed, the lobes rounded, ciliate, the stigma navel-like, 4-lobed. Pyrenes 4, oblong-obovate in outline, the ends obtuse, 3 mm. long, 2 mm. wide, palmately striate and esulcate, the striae slightly elevated, the endocarp woody.

CHINA: Taiwan: Taheizan, S. Suzuki in 1928 (TYPE, A; ISOTYPE, TU).

The entire leaves, the prominent venation, the striate and esulcate pyrenes of *Ilex suzukii*, indicate close relationship with *Ilex mertensii* Maxim. However, the latter species has large thick-coriaceous leaves 5-9(-16) cm. long and, also, large fruits 8-9 mm. in diameter. This species has been mistakenly identified as *Ilex hanceana* Maxim. in the past. This last species can readily be distinguished by the pubescent branchlets, the short petioles (2-5 mm. long), the obscure veins, the fruiting pedicels 1-1.5 mm. long, and the smaller fruits.

52. *Ilex denticulata* Wall. List 4333. 1830, nom. nud.; Wight, Ill. Ind. Bot. 2: 147, *pl.* 149. 1850; Beddome, Fl. Sylv. 1: 142. 1869; Hooker f., Fl. Br. Ind. 1: 600. 1875; Maxim. in Mém. Acad. St. Pétersb. VII, 29(3): 29. 1881; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 320 (Monog. Aquif. 1: 320). 1901.

Ilex nilagirica Miq. ex Hook. f., l. c.

A glabrous evergreen tree with coriaceous ovate-elliptic, elliptic, or oblong leaves, obtuse or shortly acuminate apices, serrate margins, pseudo-paniculate staminate and pseudoracemose pistillate inflorescences, globose fruits, and stony, irregularly striate, sulcate and wrinkled pyrenes.

Branchlets straight, glabrous, brunneous, second year's growth subterete, 3-5 mm. in diameter, minutely rimulose, the lenticels lacking, the leaf-scars deltoid, not elevated; current year's growth subangular, striate, 3 mm. in diameter; terminal buds narrowly conic, the scales cartilaginous, eciliate. Leaves occurring also on second year's growth, 1-2 cm. apart; stipules lacking or very minute, callose and nigrescent; petioles rather stout, 10-13 mm. long, one-fifth to one-seventh the length of the lamina, glabrous, narrowly or not at all sulcate above, rugose beneath; lamina coriaceous, olivaceous or cinereous-olivaceous, ovate-elliptic or elliptic-oblong, 5-10 cm. long, 2.5-3.7 cm. wide; base obtuse or cuneate; apex very shortly and abruptly acuminate or obtuse, the acumen 3-8 mm. long; margin densely and often irregularly denticulate-serrate, the teeth nigrescently apiculate; midrib glabrous, narrowly impressed above, elevated beneath, the lateral nerves 6-9 pairs, obscure above, prominent beneath, the reticulations obscure above, evident beneath. Staminate inflorescences: pseudo-paniculate, axillary, sessile, only on the second year's growth, the rachis 4-14 mm. long, the individual branches 1-3-flowered, the bracts obovate, acute, 4 mm. long, 2-5 mm. wide; 3-flowered cymes with peduncles 2 mm. long, the pedicels 2-3 mm. long, the uni-flowered pedicels 5 mm. long, glabrous, with 2 submedian deltoid prophylla; flowers 4-merous; calyx patelliform, 2.5 mm. across, glabrous, the lobes deltoid, ca. 0.57 mm. long, 1 mm. wide, acute or acuminate, entire, eciliate; corolla rotate, 7 mm. across, the petals oblong, reflex, 3 mm. long, 1.5 mm. wide, one-tenth connate at the base; stamens equaling the petals in length, the anthers small, ovoid, ca. 0.75 mm. long; rudimentary ovary globose, the apex rounded and slightly depressed. Infructescences fascicu-

late or pseudoracemose, the central axis 5–10 mm. long, the individual branches uniflorous, the fruiting pedicels 6–10 mm. long, glabrous or sparsely puberulous. Fruits globose or depressed globose, 6–7 mm. in diameter, brown and smooth, the persistent calyx explanate, 3 mm. in diameter, the stigma navel-like, often depressed, 4-lobed. Pyrenes 4, oblong or elliptic in outline, irregularly striate, sulcate, wrinkled and pitted, ca. 4–5 mm. long, 3 mm. wide, the endocarp stony.

CHINA: Yunnan: Fo-hai, C. W. Wang 77406 (A).

INDIA: Madras, D. Brandis 666; Nilghiri, Ed. Hohenacker 1455 (A), 1456 (fragment, A); Culgherris, Perrottet (A); Nilghiri Hills, E. H. Wilson; Wight 437 (ISOTYPE, G, NY), 438 (NY), 490 (fragment, A).

Ilex denticulata was first recorded from Nilghiri Hills of India as a large tree up to 12 m. high. Specimens collected from the type locality vary in the degree of their pubescence. Some of them (Wight 437, 490; Hohenacker 1455) are entirely glabrous, and others (Hohenacker 1456) are with slightly pubescent pedicels. In the form, size, and margin of the leaves, pubescence of the inflorescences, size of the fruit, and number and nature of the pyrenes, the Chinese specimens collected from southwestern Yunnan match the Indian type very well, with the exception of the more pubescent pedicels. In Yunnan, the plant grows to be a big tree up to 12 m. high. It occurs in mixed forests at an altitude of 2000 m.

In its irregularly wrinkled and pitted stony pyrenes and the navel-like stigma, *Ilex denticulata* is closely related to *Ilex latifolia* Thunb., but the latter has thick-coriaceous larger (8–17 cm. long, 4.5–7.5 cm. wide) leaves and 3–9-flowered individual branches in the staminate pseudopanicles. The leaves of *Ilex denticulata* resemble superficially those of *Ilex chieniana* S. Y. Hu, but the latter has palmately striate and sulcate pyrenes, thickly discoid or capitate stigmata, and ciliate calyx-lobes.

53. *Ilex graciliflora* Champ. in Jour. Bot. Kew Gard. Miscel. 4: 328. 1852; Walp. Ann. 4: 429. 1857; Benth. Fl. Hongk. 65. 1861; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 43. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 1: 116. 1886; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 338 (Monog. Aquif. 1: 338). 1901; Dunn & Tutcher in Kew Bull. Misc. Inf. Add. Ser. 10: 60. 1912.

An evergreen tree up to 6–9 m. high with rather stout branchlets, obovate or oblong-elliptic leaves, minutely and loosely serrulate or subentire leaves, fasciculate inflorescences, globose fruit with plane and thin-discoid stigmata and 4 wrinkled and rugose, irregularly striate-sulcate pyrenes.

Branchlets subterete, castaneous or rarely brunnaceous when dry; third year's growth 3–4 mm. in diameter, longitudinally rimulose, the lenticels lacking, the leaf-scars deltoid, not elevated; second year's growth 2.5 mm. in diameter, longitudinally plicate, rugose, glabrous; current year's growth 1.8–2 mm. in diameter, angular, longitudinally ridged, minutely and sparsely puberulous, glabrescent or glabrous, the terminal bud conic, acute, pubescent. Leaves occurring even on the third year's growth, 5–20

mm. apart; stipules minute, often hidden; petioles 10–15 mm. long, one-fifth to one-half the length of the lamina, glabrous or minutely puberulous above, narrowly and deeply canaliculate, the distal half winged by the decurrent leaf-base; lamina thickly coriaceous, olivaceous-brunneous when dry, shiny above, less so beneath, obovate- or oblong-elliptic, 2–7.5 cm. long, 1.5–3.5 cm. wide; obtuse or acute at the base; obtuse, rarely acute or retuse at the apex; margin minutely and remotely serrulate or rarely subentire; midrib impressed and glabrous above, elevated beneath, the lateral nerves 5–7 pairs, obscure above, prominent beneath, loosely reticulate, the veinlets evident on the lower surface. Inflorescences fasciculate, axillary, on last year's growth, with abortive terminal buds, the bracts ovate-deltoid, acute or tricuspidate, puberulous; flowers 4-merous. Staminate flower: individual branches of the fascicles 3-flowered; peduncles shorter than the pedicels, 1–2 mm. long, the pedicels 3–6 mm. long, both sparsely puberulent or glabrescent, the prophylla 1 or 2, basal or sub-basal; calyx patelliform, 2 mm. across, shallowly 4-lobed, the lobes deltoid, obtuse or rounded, ciliate; corolla rotate, reflexed, 6 mm. across, the petals oblong, 2.5 mm. long, one-eighth connate at the base, ciliate; stamens shorter than the petals, the anthers oblong-ovoid; rudimentary ovary subglobose-ovoid, obtuse at the apex, inconspicuously 4-lobed. Pistillate flower: individual branches of the fascicles uniflorous, the bracts small, ovate, cuspidate or tricuspidate; pedicels 4 mm. long (after fruiting 6 mm. long) with 2 basal prophylla; calyx as in the staminate flowers; corolla choripetalous, the petals oblong-obovate, 2.5 mm. long; staminodes two-thirds as long as the petals, the sterile anthers sagittate; ovary globose-ovoid, 1.5 mm. in diameter, the stigma discoid. Fruit globose, 5–6 mm. in diameter, the persistent calyx explanate, 2 mm. in diameter, suborbicular in outline, ciliate, the stigma plane, thin-discoid. Pyrenes 4, suborbicular in outline, the ends rounded, 4 mm. long, 3 mm. wide, wrinkled and rugose, irregularly striate-sulcate, the striae reticulate, the back shallowly impressed, the endocarp woody.

CHINA: Hongkong: *Champion* (fragment of type, A); Wu-kau-tin, *W. Y. Chun* 5039 (A); Ford (staminate flowers, A, NY; fruiting branches, A); *Lamont* (B); Lugard Road, *Y. W. Taam* 1603 (A); Wong-neichong, *Y. W. Taam* 2013 (A); along Bride Valley, *Y. Tsiang* 49 (A); Peak, *Y. Tsiang* 256 (A, NY); Mt. Victoria, *W. J. Tutchner* (ex Herb. Hongkong no. 10213) (A); *C. Wright* (NY, US). Lantau Island: *C. L. Tso* 20193 (A).

Ilex graciliflora is endemic to Hongkong and the near-by islands, where it can be found growing in woods or in thickets as a tree 6–9 m. high. The white flowers appear in April. The red fruits persist long on the tree, even into February or later of the following year.

The glabrescent branchlets, the coriaceous leaves, the fasciculate inflorescences, and the wrinkled and rugose pyrenes of *Ilex graciliflora* indicate close relationship between this species and *Ilex ficoidea* Hemsl., which differs in having leaves with caudate apices, 9 or 10 indistinct parallel lateral nerves, median or submedian prophylla, and very short fruiting pedicels (2–3 mm. long).

54. *Ilex tsangii*, sp. nov.

Arbor glaberrima; ramulis nigrescentibus; foliis subcoriaceis, ellipticis vel ovato-ellipticis, 5–8 cm. longis, 2–3 cm. latis, crenulatis vel subintegris, basi acutis vel cuneatis, apice acuminatis, acuminibus 10–15 mm. longis, costa supra impressa, subtus elevata, nervis lateralibus, utrinque 6–8, supra obscuris, subtus evidentibus; inflorescentiis fructiferis fasciculatis, axillaribus; pedicellis 10–12 mm. longis; fructibus depresso-globosis, 5 mm. longis, 6 mm. diametro; calycibus persistentibus 1.5 mm. diametro, stigmatibus minute discoideo; pyrenis 4, 4 mm. longis, 3 mm. latis, striatis, rugosis et sulcatis, endocarpio coriaceo.

An entirely glabrous evergreen tree up to 8 m. high with nigrescent branchlets, elliptic leaves with minutely crenulate or subentire margin, long-acuminate apices, fasciculate infructescences, slender fruiting pedicels 10–12 mm. long, and rather small globose fruits.

Branchlets slender, subterete, glabrous; third year's growth 2 mm. in diameter, sparsely and minutely rimulose, the lenticels lacking, the leaf-scars elevated; current year's growth 1–1.5 mm. in diameter, angular, the terminal bud narrowly conic, acute, glabrous. Leaves occurring even on the third year's growth, 5–12 mm. apart; stipules very minute, often obscure; petioles slender, 10–16 mm. long, one-sixth to one-fifth the length of the lamina, narrowly canaliculate above; lamina subcoriaceous, bruneous-olivaceous when dry, ovate-elliptic or elliptic, 5–8 cm. long, 2–3 cm. wide; acute or cuneate at the base; acuminate at the apex, the acumen 10–15 mm. long; margin remotely and inconspicuously crenulate or subentire; midrib narrowly and shallowly impressed above, elevated beneath, the lateral nerves 6–8 pairs, obscure above, evident beneath. Flowers not seen. Infructescences fasciculate, axillary, on second year's growth, fascicles with 2–4 fruits, the fruiting pedicels slender, 10–12 mm. long with 2 minute ciliate basal prophylla. Fruit depressed globose, 5 mm. long, 6 mm. in diameter, when dry black and rugose, the persistent calyx minute, 1.5 mm. in diameter, the stigma minute, thin-diskoid. Pyrenes 4, obovate in outline, 4 mm. long, 3 mm. wide, one end slightly pointed, reticulately striate, irregularly rugose and sulcate, the endocarp thick-coriaceous (described from immature fruit).

CHINA: Kwangtung: Ta-pu, *W. T. Tsang* 21232 (TYPE A; LU).

This species is endemic to northeastern Kwangtung, where it is a common tree in woods or thickets. The fruit has been reported as yellow in July. The species is closely related to *Ilex graciliflora* Champ., which differs in having thick-coriaceous leaves with obtuse apices.

55. *Ilex chingiana* Hu & Tang in Bull. Fan. Mem. Biol. Bot. 9: 252. 1940.

A glabrous evergreen tree up to 12 m. high with large (11–15 cm. long) coriaceous, oblong-elliptic, remotely serrate and acuminate leaves, very large (15 mm. in diameter) globose fruit, and 4 large wrinkled and pitted pyrenes.

Branchlets robust, straight, glabrous, castaneous when dry; third year's growth 3.5–4.5 mm. in diameter, transversely plicate-rugose when dry, the lenticels lacking, the leaf-scars semi-orbicular; second year's growth longitudinally plicate-rugose, subterete, 3–4 mm. in diameter; current year's growth angular, longitudinally striate, 2.5–3 mm. in diameter, the terminal buds small, conical, the scales glabrous, ciliate, the axillary buds globose, glabrous. Leaves occurring even on the third year's growth, 5–20 mm. apart; stipules obscure; petioles 10–15 mm. long, one-tenth to one-seventh the length of the lamina, glabrous, rugose, narrowly canaliculate above; lamina thick-coriaceous, brunneous-olivaceous when dry, glabrous, rather opaque on both surfaces, oblong-elliptic or very rarely oblanceolate, 11–14 cm. long, 4–5 cm. wide; base obtuse, rarely rounded or cuneate; apex acuminate, the acumen 7–12 mm. long; margin remotely serrate; midrib impressed above, sparsely and minutely puberulent, very prominent and elevated beneath, the lateral nerves 8–12 pairs, slightly elevated above, evident beneath, the reticulation of the veinlets conspicuous above, less so beneath. Infructescence a small fascicle, usually only one fruit maturing; bracts cartilaginous, glabrous, the apex acute, callose, the basal appendage stipule-like, acute, ciliate; fruiting pedicels 2–4 mm. long, minutely and sparsely puberulent when young, glabrescent later, with 2 sub-basal prophylla; persistent calyx explanate, orbicular in outline, 3.5 mm. in diameter, inconspicuously 4-lobed, the lobes rounded, sparsely puberulent and ciliate; fruits globose, 15 mm. in diameter, the stigma navel-like, orbicular in outline when young, later appearing quadrangular, 4–5 mm. in diameter. Pyrenes 4, obovate in outline, 10–12 mm. long, 6–8 mm. wide at the base, reticulately striate, sulcate, wrinkled and pitted, the back flattened and broadly impressed, the endocarp stony.

CHINA: Kweichow: San-hoa, *Y. Tsiang* 6396 (NY). Kwangsi: Lu-chen-hsien, *R. C. Ching* 6011 (ISOTYPE, A, US), Chuen-yuen, *T. S. Tsoong* (= *Z. S. Chung*) 82033 (A); Ping-nan-hsien, *C. Wang* 40344 (A), 40388 (A).

Ilex chingiana is endemic to Kwangsi Province, where it grows as a tree in mixed forests. Specimens collected in June show very young fruits. This may indicate that it flowers in May. Those collected in November have large red fruits.

Because of the large leaves with remotely serrate margins, the large fruit with navel-like stigmas, and the large reticulately striate, sulcate, wrinkled and pitted pyrenes, this Kwangsi species is closely related to the Hainan species *Ilex nuculicava* Hu. The latter species has puberulent branchlets and petioles, pseudoracemose infructescences with smaller fruits, and longer fruiting pedicels.

The infructescences of the material at hand appear solitary, but on careful examination the paucifasciculate nature can easily be detected, for the scars of the falling flowers and bracts are evident.

Only fruiting material has been available for this study. The size of the fruits on these specimens varies considerably with seasonal variation.

As the fruit matures, the mesocarp increases in volume and becomes fleshy. As the fruits enlarge, the tissue of the exocarp next to the stigmatic lobes is torn. When dry, this rent and discolored tissue gives the stigmata a star-like outline. This character, the star-like stigma, is characteristic for this species and a diagnostic character.

When the ripe fleshy fruit is pressed, the exocarp breaks and the fruit flattens. On herbarium specimens such pressed fruits appear much larger than their actual size. This is plainly the case with *C. Wang* 40344 and 40388.

55a. *Ilex chingiana* var. *puberula*, var. nov.

Arbor parva; ramulis glabris, castaneis, gemmis terminalibus pubescentibus; foliis oblanceolatis, 7–12 cm. longis, 3 cm. latis, serratis, basi cuneatis, apice acuminatis, acuminibus 8–14 mm. longis, costa et petiole puberulis; fructibus globosis, 11 mm. diametro, pedicellis pubescentibus, 3 mm. longis.

CHINA: Kwangsi: Ling-wun, S. K. Lau 28662 (TYPE, A).

This variety grows in mixed forest as a tree 10 m. high with a trunk 30 cm. in diameter.

The variety differs from the typical *Ilex chingiana* in that it has narrower predominantly oblanceolate leaves with cuneate bases and puberulent terminal buds and petioles.

56. *Ilex uraiensis* Yamamoto in Jour. Soc. Trop. Agric. Taiwan 4: 486. 1932.

Ilex glomeratiflora sensu Yamamoto, Suppl. Ic. Pl. Form. 1: 32, fig. 13. 1925, non Hayata.

An evergreen tree up to 25 m. high, with minutely puberulous or glabrescent branches, elliptic or obovate-elliptic leaves, remotely crenate or serrate margins, abruptly and shortly acuminate apices, fasciculate inflorescences, fruiting pedicels 6–8 mm. long, large globose fruit, and irregularly striate and wrinkled stony pyrenes.

Branchlets subterete, cinereous or rarely nigrescent when dry; third year's growth 3 mm. in diameter, longitudinally rimulose, the lenticels lacking, the leaf-scars crescent-shaped, slightly elevated; current year's growth 1–2 mm. in diameter, longitudinally ridged, minutely puberulous or glabrescent, the terminal buds ovoid, pubescent. Leaves occurring also on second year's growth, rarely on the third year's growth, 5–12 mm. apart; stipules minute, deltoid, persistent; petioles 6–10 mm. long, one-tenth to one-sixth the length of the lamina, the distal half winged by the decurrent leaf-base, narrowly canaliculate above; lamina thinly coriaceous, olivaceous when dry, shiny above, opaque beneath, elliptic or obovate-elliptic, 3.5–10 cm. long, 1.2–3.5 cm. wide, cuneate at the base, shortly and abruptly acuminate at the apex, the acumen 3–8 mm. long, the very tip obtuse, the margin remotely crenate or serrate; midrib very slightly impressed above, elevated beneath, the lateral nerves 8–9 pairs, prominent on both surfaces, the reticulation of the veinlets prominent on both sur-

faces. Inflorescences fasciculate, axillary on the second or even the third year's growth, the individual branches of the fascicles uniflorous, the bracts suborbicular, ciliate; flowers 4-merous. Staminate flowers: pedicels 3-5 mm. long, minutely puberulous, with 2 minute ciliate prophylla at the base; calyx patelliform, 2 mm. in diameter, shallowly 4-lobed, the lobes rounded, ciliate; corolla rotate, 7-8 mm. in diameter, the petals obovate-oblong, 3-5 mm. long, 2.5 mm. wide, ciliate, slightly connate at the base; stamens longer than the petals, the anthers oblong-ovoid, 1.25 mm. long; rudimentary ovary subglobose, the apex rounded or slightly depressed. Pistillate flowers not seen. Infructescences fasciculate, the bracts oblong-ovate, puberulous, and ciliate, with 2 acute stipule-like appendages; fruiting pedicels slender, 6-8 mm. long, pubescent, with 2 sub-basal, deltoid, acute, puberulous, ciliate prophylla. Fruit globose, large, 10-11 mm. in diameter, the persistent calyx suborbicular in outline, 2 mm. in diameter, ciliate, the stigma navel-like, 2.5 mm. in diameter. Pyrenes 4, oblong in outline, the ends obtuse, 7-8 mm. long, 4.5 mm. wide, irregularly striate and wrinkled, the back flattened and depressed, the endocarp stony.

CHINA: Taiwan: *R. Kanehira* & *S. Sasaki* in 1916 (photo of TYPE, TU); *Y. Shimada* (TU); Sozan, *E. H. Wilson* 10288 (A, NY, US), 11213 (A, US); Sirin, *K. Odashima* (Taihoku Imp. Univ. Herb. no. 17751) (A, NY, US); Kiirun (Taihoku Imp. Univ. Herb. no. 17797) (A, NY, US); Herb. Univ. Imp. Taihoku no. 2872 (TU).

This species is endemic to Taiwan, where it grows as a common tree up to 25 m. high with a trunk 0.5-1 m. in diameter. The white flowers appear in April, and the mature red fruit persists on the tree during the winter months.

The slender fruiting pedicels, large fruits, navel-like stigma, and the shiny upper surface of the leaves with prominent lateral nerves of this species indicate a close relationship with *Ilex mertensii* Maxim., which has thickly coriaceous leaves with obtuse apices, and palmately striate esulcate pyrenes with sublignified endocarps.

56a. *Ilex uraiensis* var. *formosae*, comb. nov.

Ilex mertensii Maxim. var. *formosae* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 338 (Monog. Aquifol. 1: 338). 1901.

Branchlets glabrous; leaves coriaceous, obovate, 2.5-4.5 cm. long, 1.5-2.5 cm. wide, cuneate at the base, rounded or rarely obtuse at the apex, olivaceous when dry, shiny above, the margin remotely crenulate, the midrib plane or slightly impressed above, elevated beneath, the lateral nerves 4-6 pairs, prominent on both surfaces, the reticulation of the veinlets evident on both surfaces; infructescences fasciculate, uniflorous, the fruiting pedicels 5-10 mm. long, glabrous, with 2 basal prophylla; fruit globose, 10-12 mm. in diameter, the persistent calyx inconspicuous, 1.5 mm. in diameter, the stigma navel-like, 1.5 mm. in diameter; pyrenes 4, oblong in outline, obtuse at the base, obtuse and retuse at the apex, 8 mm. long, 5 mm. wide, irregularly striate and wrinkled, the back flattened and depressed, the endocarp stony.

CHINA: Taiwan: S. Cape, *A. Henry* 938 (A, US), 1002 (ISOSYNTYPE of *Ilex mertensii* var. *formosae*) (A), 1251 (ISOSYNTYPE of *Ilex mertensii* var. *formosae*) (A, NY).

The form of the leaf of this variety is like that found in *Ilex mertensii* Maxim., but the texture resembles that found in *Ilex uraiensis*. Thus superficially it may be considered as a variety of either of these two species. The large stony pyrenes of this variety, however, are typically those of *Ilex uraiensis*; hence it has been transferred to this species.

57. *Ilex subficoidea*, sp. nov.

Ilex cinerea sensu Groff in Lingnan Sci. Bull. 2: 63. 1930, non Champ.

Arbor; ramulis glabris; foliis coriaceis, supra nitidis, ovato- vel oblongo-ellipticis, 7–10 cm. longis, 3 cm. latis, crenatis, basi obtusis, raro rotundatis, apice acuminatis, acuminibus, 7–16 mm. longis, costa supra impressa, subtus elevata, nervis lateralibus 10–11 paribus, supra obscuris, subtus evidentibus; inflorescentiis fasciculatis, axillaribus. flores 4-meris; ♂ 3-floribus, pedunculis 1 mm. longis, pedicellis 2 mm. longis; calycibus 4-lobatis, ciliatis; corolla rotata, 7 mm. diametro, petalis obovato-oblongis, 2.75 mm. longis, sparse ciliatis, staminibus quam petalis longioribus, ovario abortu conico, apice obtuso; infructescentiis fasciculatis, pedicellis 10 mm. longis; fructibus globosis, 10–12 mm. diametro, tuberculatis, stigmate applanato-discoideo; pyrenis 4, 8–9 mm. longis, 5–7 mm. latis, irregulariter rugosis et caveatibus.

An evergreen tree up to 15 m. high, with glabrous longitudinally striate branchlets, ovate- or oblong-elliptic coriaceous and glossy leaves with an abruptly acuminate apex, large (10 mm. in diameter) fasciculate fruits, and large woody wrinkled pyrenes.

Branchlets straight, cinereous, brunneous, or even olivaceous; third year's growth 3–4 mm. in diameter, longitudinally striate and minutely rimulose, the lenticels lacking, the leaf-scars deltoid, ovate, not elevated; current year's growth striate, angular, 1.5–2 mm. in diameter, glabrous, the terminal bud thinly conical, glabrescent or glabrous, the scales densely ciliate. Leaves occurring also on second year's growth, 1–2 cm. apart; stipules minute, broadly deltoid, callose; petioles 5–12 mm. long, one-fourteenth to one-seventh as long as the lamina, canaliculate above, the distal half narrowly winged by the decurrent base; lamina coriaceous, olivaceous when dry, ovate- or oblong-elliptic, 7–10 cm. long, 3 cm. wide; obtuse at the base, seldom rounded, the apex abruptly acuminate, the acumen 7–16 mm. long, the tip obtuse, shiny above, opaque beneath; margin undulate, inconspicuously crenate, the teeth marked with black spots; midrib impressed above, elevated beneath, the lateral nerves 10–11 pairs, obscure above, evident beneath, rather straight, curving upward and reticulate near the margin. Inflorescence fasciculate, axillary, on second year's growth; flowers 4-merous. Staminate inflorescence: individual branches of the fascicles 3-flowered, the bracts broadly ovate, mucronate, ciliate, the basal appendages stipule-like; peduncles 1 mm. long, the pedicels 2 mm. long, pubescent or glabrescent; calyx patelliform, 5 mm.

across, the lobes glabrous, very sparsely ciliate; corolla rotate, 6 mm. across, the petals obovate-oblong, 2.75 mm. long, the apical half very sparsely and weakly ciliate, one-tenth connate at the base; stamens slightly longer than the petals, the anthers ovoid, 0.75 mm. long; rudimentary ovary obtusely conical, glabrous. Pistillate flower not seen. Infructescences fasciculate, the pedicels 10 mm. long, with 2 basal or sub-basal prophylla. Fruit globose, 10–12 mm. in diameter, tuberculate, the persistent calyx 2.5–3 mm. across, 4-lobed, the lobes rounded, ciliate; stigma thin-discoïd, distinctly 4-lobed. Pyrenes 4, ovate-elliptic in outline, the ends pointed, 8–9 mm. long, 5–7 mm. wide, irregularly wrinkled and pitted, the endocarp stony.

CHINA: Kiangsi: Kien-nan, *S. K. Lau* 3979 (TYPE, fruits, A, US). Kwangtung: Wung-yuen, *S. K. Lau* 2304 (A); Lung-t'au Mt., CCC 12736 (US). Kwangsi: S. Nan-ning, *R. C. Ching* 8220 (NY). Hainan: *H. Y. Liang* 63772 (NY), *C. Wang* 34710 (A, NY), 36535 (A).

INDO-CHINA: Tonkin, *W. T. Tsang* 26911 (A).

Ilex subficoidea is a large subtropical tree found in mixed forests south of Lat. 25°N. The flowers are white and appear in January.

The Hainan plants have long petioles and short leaves. But these differences fall within the range of variations displayed by the plant on the mainland.

58. *Ilex nuculicava*, sp. nov.

Ilex cinerea Champ. var., Merr. in Lingnan Sci. Jour. 5: 115. 1928;

Masamune, Fl. Kainant (Hainan) 137. 1940.

Arbor parva; ramulis pubescentibus vel glabrescentibus; foliis coriaceis, oblongo-ellipticis vel raro oblanceolatis, 8–13.5 cm. longis, 2.2–4.5 cm. latis, subintegris, undulatis, vel crenulatis, basi obtusis, apice breviter acuminatis, acuminibus 5–10 mm. longis, costa supra impressa, nervis lateralibus 7–8 paribus, supra obscuris, subtus evidentibus; inflorescentiis fasciculatis, axillaribus, pubescentibus; floribus 4-meris; ♂ 3-floribus, pedunculis 1–2 mm. longis, pedicellis 3–4 mm. longis, calycibus ciliatis, corolla rotata, 7–8 mm. diametro, petalis oblongo-obovatis, 3 mm. longis, staminibus petalis aequantibus, ovario abortu subgloboso vel ovoideo, apice obtuso; ♀ unifloribus, pedicellis 3 mm. longis, corolla choripetala, ovario ovoideo, 2.5 mm. longo, 2 mm. diametro, apice truncato, stigmate discoideo; fructibus globosis, 10 mm. diametro, stigmate umbilicato; pyrenis 4, 6–7 mm. longis, 4–4.5 mm. latis, dorso palmatim striatis et sulcatis, lateralibus rugosis et caveatibus.

An evergreen tree up to 9 m. high with puberulent or glabrescent branchlets, large oblong-elliptic acuminate leaves, fasciculate flowers, large globose drupes and large bony wrinkled and pitted pyrenes.

Branchlets straight, cinereous, plicate and rugose when dry; third year's growth 5 mm. in diameter, longitudinally plicate, rimulose, the lenticels lacking, the leaf-scars semi-orbicular, not elevated, closely associated with the elevated scars of the inflorescences; second year's growth 3 mm. in diameter; current year's growth 1.75–2 mm. in diameter, longitudinally

ridged, sparsely pubescent, the terminal buds conic, 3 mm. long, the scales pubescent. Leaves occurring also on second year's growth, 2–12 mm. apart; stipules minute, often obscure; petioles slender, 9–15 mm. long, one-eleventh to one-seventh the length of the lamina, castaneous or nigrescent when dry, canaliculate, sparsely puberulent above, the distal half winged by the decurrent base, rugose beneath; lamina coriaceous, olivaceous when dry, opaque above, paler and opaque beneath, oblong-elliptic or rarely oblanceolate, 8–13.5 cm. long, 2.2–4.5 cm. wide; base obtuse; apex short-acuminate, the acumen 5–10 mm. long; margin subentire, undulate, minutely crenate, marked with black spots; midrib impressed above, sparsely and minutely pubescent, prominent and glabrous beneath, the lateral nerves 7 or 8 pairs, straight, curved upward and loosely reticulate near the margin, obsolete above, evident or prominent beneath, the reticulation of the veinlets obscure above, lacking beneath. Inflorescences fasciculate, axillary, on second year's growth, the scales of the flowering buds persistent, reniform, acute, pubescent, 1 mm. long, 1.5 mm. wide; flowers 4-merous. Staminate inflorescence: individual branches of the fascicles 3-flowered, the bracts broad-ovate, acute, pubescent, with pubescent stipule-like basal appendages, the peduncles 1–2 mm. long, densely pubescent, the pedicels 3–4 mm. long, pubescent, with 0–2 basal or rarely submedian prophylla; calyx patelliform, sparsely pubescent, 2–2.5 mm. in diameter, 4-lobed, the lobes rounded, ciliate, 0.75 mm. long, 1.25 mm. wide; corolla rotate, 7–8 mm. in diameter, the petals oblong-obovate, 3 mm. long, 2 mm. wide, shortly and sparsely ciliate or eciliate, lightly connate at the base; stamens equaling the petals in length, the anthers ovoid, 1.25 mm. long; rudimentary ovary subglobose or ovoid, the apex rounded or obtuse. Pistillate inflorescences: individual branches uniflorous, the pedicels 3 mm. long with 2 basal prophylla, the calyx and corolla as in the staminate flowers; staminode one-third the length of the petals, the sterile anthers sagittate; ovary ovoid, 2.5 mm. long, 2 mm. in diameter, the apical end truncate, the stigma discoid. Fruit globose, 10 mm. in diameter, when dry cinereous and wrinkled, the pedicels 5–6 mm. long, the persistent calyx explanate, 2.5 mm. in diameter, pubescent and ciliate, the stigma navel-like, 3 mm. across. Pyrenes 4, broad-elliptic in outline, tapering at the ends, 6–7 mm. long, 4–4.5 mm. wide, palmately striate and sulcate on the back, wrinkled, pitted and rugose on the sides, the endocarp woody.

CHINA: Hainan: Fan-yah, *N. K. Chun & C. L. Tso*, 44244 (TYPE, A; NY, US, fruit); Po-ting, *F. C. How* 72490 (A); Man-ning, *F. C. How* 73195 (A); Ch'ang-kiang, *S. K. Lau* 1714 (A, NY); Bak-sa, *S. K. Lau* 26006 (A), 26550 (A), 26697 (A); Five Finger Mt., *F. A. McClure* (CCC no. 9424) (A, NY), 9458 (A, US), 9534 (US); without precise locality, *C. Wang* 34741 (NY).

This species is endemic to the island of Hainan, where it grows in woods or forests at altitudes of 500–1800 m. The flowers appear in April or May.

A close relative is *Ilex cinerea* Champ. Many herbarium sheets have

been incorrectly so named. *Ilex nuculicava* resembles *Ilex cinerea* in having pubescent branchlets and terminal buds, and large oblanceolate or oblong-elliptic opaque leaves, but the latter can readily be distinguished by the characteristic short petiole (2–4 mm. long) and the twice trichotomously branched staminate inflorescences.

58a. *Ilex nuculicava* var. *brevipedicellata*, var. nov.

Arbor parva; ramulis et gemmulis terminalibus pubescentibus; foliis oblongo-ellipticis vel oblanceolatis, 7–17 cm. longis, basi cuneatis, apice acuminatis; fructibus globosis, pedicellis 2 mm. longis; pyrenis 4, 6 mm. longis, 5 mm. latis, dorso rugosis et caveatibus.

CHINA: Hainan: N. K. Chun & C. L. Tso 43859 (TYPE, A; US).

This variety differs from the species in having shortly pedicellate fruits.

58b. *Ilex nuculicava* var. *glabra*, var. nov.

Arbor parva; ramulis et gemmulis terminalibus glabris; foliis lanceolatis vel oblanceolatis, 8–11 cm. longis, 2–3 cm. latis, basi cuneatis, apice acuminatis; fructibus globosis, 9 mm. diametro, calycibus ciliatis; pyrenis 4, 6–8 mm. longis, 5 mm. latis, dorso rugosis et caveatibus.

CHINA: Hainan: Yai-chow, F. C. How 71094 (TYPE, A; NY, US).

This variety differs from the species in having glabrous buds, branchlets, and inflorescences.

58c. *Ilex nuculicava* var. *auctumnalis*, var. nov.

Arbor parva; gemmulis terminalibus pubescentibus, foliis coriaceis, supra nitidis, oblanceolatis, 6–11 cm. longis, 2–3.5 cm. latis, basi cuneatis, apice acuminatis; inflorescentiis fasciculatis.

CHINA: Hainan: Ling-shui, F. C. How 73800 (A); Po-ting, F. C. How 73857 (A); Yai-chow, H. Y. Liang 62751 (TYPE, A; NY).

This variety differs from the species in having smaller and narrower oblanceolate leaves, with cuneate bases, and in its late flowering season. In Hainan it flowers in the autumn, August-October. No fruiting specimens were available for this study. Additional material may prove it to be a distinct species.

(To be continued)

THE GENUS *COCCOLOBA* IN CUBA

RICHARD A. HOWARD

THE NEW WORLD GENUS *Coccoloba* is found from Bermuda and Florida on the North American continent, through the West Indies, Mexico and Central America, into South America with many species in the Amazon basin and a few species as far south as Argentina. In 1890, Lindau published a comprehensive monograph of this woody genus (Engl. Bot. Jahrb. 13: 106-229. 1890) which then included 125 species. Lindau's monograph is notoriously difficult to use and Britton, for his work on the West Indian vegetation, presented a series of treatments of the genus *Coccoloba* as it occurred on each of the islands he studied. Britton's first paper on the genus, in 1915, revised *Coccoloba* for Cuba. In following years Britton described additional new species from Cuba, as did Urban, and subsequent to their work Schmidt continued studies of the genus in Cuba and the Caribbean area. Thus, at the present time approximately 50 species have been reported from Cuba alone, either in the literature or in herbarium records.

The present paper, which considers the genus only in Cuba, is presented to clarify certain points of the morphology of the genus, to describe several new species from Cuba and Hispaniola, and to straighten out specific concepts and bring the nomenclature up to date to aid the work of contemporary students of the Caribbean vegetation.

The author is grateful to Brother Leon of the Colegio de la Salle in Havana, Cuba, for the introduction to this problem and also to Mr. Sandwith of Kew for invaluable help and consultation on certain problems of limitation of the species. Material for this work was supplied from the following herbaria: Arnold Arboretum (A), Jardin Botanique de l'Etat, Brussels, Belgium (BR), Botanical Museum, Copenhagen, Denmark (C), Chicago Natural History Museum (formerly known as the Field Museum) (FM), Gray Herbarium (G), Colegio de la Salle, Havana (HAB), Sauvalle Herbarium of the Academy of Science in Havana (HABA), Kew (K), Univ. of Michigan (MICH), Missouri Botanical Garden (MO), New York Botanical Garden (NY), Herbarium of Juan Roig (R), Natural History Museum, Stockholm, Sweden (S), Estacion Agronomica de Cuba (SV), and the United States National Herbarium (US). I am grateful to the directors and curators of these herbaria for the privilege of studying their material on loan.

In this paper I am following, with qualifications which are mentioned, the proposal of Little (Madroña 7: 244-246. 1944) that the name *Coccoloba* should be conserved. Patrick Browne (Civ. Nat. Hist. Jamaica 209, pl. 14, f. 3. 1756) originated the name *Coccolobis* (without generic description) for four species. Linnaeus (Syst. Nat. ed. 10, 1007, 1367.

1759) accepted Browne's four species and applied binomials to them but changed the spelling of the generic name to *Coccoloba* in publishing the first generic description. Recently Sandwith (Jour. Bot. 78: 99. 1940) has regarded *Coccolobis* P. Br. and *Coccoloba* L. as different names and adopted the original Browne name and spelling. Moreover, Sandwith states in his argument that *Coccolobis* is a diminutive name, thus a completely different word, and therefore transfers and new combinations are necessary when one name or the other is adopted. Fortunately for the present monographer *Coccolobis* is not a diminutive form, as *Coccolobion* would be, and the new combinations are not necessary. Actually no problem exists between these two words for *Coccolobis* of P. Browne is invalidly published as a generic name under the present rules of botanical nomenclature while *Coccoloba* L. is a valid publication with the first generic description of the group. Considerable search and bibliographic work would be necessary to determine who published the first valid generic description under the name *Coccolobis*.

However the name for this genus still involves a problem. The generic name *Guaibara* Miller (Gard. Dict. ed. 4, vol. 2. 1754) is validly published with a generic description for the pre-Linnaean species later listed by Patrick Browne. Therefore *Coccoloba* L., the most widely accepted name for the group, must be conserved to continue in use. Little's proposal for conservation has been approved by the committee on nomenclature of the American Society of Plant Taxonomists and the case will be submitted for consideration and action at the International Botanical Congress in 1950. I am accepting Linneaus' name *Coccoloba* as only an orthographic variant of *Coccolobis*, thereby eliminating the need for new combinations of many of Britton's new species from Cuba, a step which would be necessary if one concluded that the two spellings of *Coccoloba* actually represent two different names.

Lindau's elaborate monograph of *Coccoloba* quite unfortunately introduces several very significant errors of interpretation of the morphology of the genus which has led subsequent workers astray and has built up considerable confusion in this genus.

Lindau considered the flowers of *Coccoloba* to be perfect, and only rarely unisexual by abortion. This is not the case, as careful study of herbarium material will show, and this is easily verified in field studies of the plants. The flowers are regularly unisexual and only occasionally are flowers of a male inflorescence perfect. In the course of field studies made in the Greater Antilles, Florida, and the Bahamas, within the past three years I have seen many species of *Coccoloba*. In all specimens examined in the field the plants were found to be dioecious and the staminate and pistillate plants readily distinguishable. Furthermore, the natives in the areas visited recognized the fact that some trees set fruit and other did not. Recent information from Cuba reports that cultivated specimens of *C. venosa* L. have perfect flowers in some of the staminate inflorescences so the plants may be described as dioecious, occasionally monoecious.

This condition has been recognized by a few workers but has not been incorporated in floristic treatments.

The staminate flowers are usually clustered at each node of the inflorescence. Two to five flowers are commonly produced in the axil of a single bract. In these flowers the stamens elongate and are exserted and the pistil is rudimentary with short contorted styles. Pistillate plants by contrast bear only one flower at each node on the inflorescence axis and in these the stamens are rudimentary, never developing pollen, and are included while the pistil is larger and exserted with longer divergent styles. Lindau recognized these differences in form, i.e., stamens exserted or included, flowers clustered or solitary, but failed to associate a unisexual condition with this morphological pattern. Thus one finds in Lindau's key to the species of *Coccoloba* the basic separations of flowers clustered versus flowers solitary, or stamens exserted versus stamens included. In more than one case the male and female plants of the same species have been described under different specific names.

The unisexual condition of the flower and the pattern of numerous flowers per node in the staminate plants may be confused slightly in the field by the fact that occasionally a male plant will form sterile fruits. This was observed in several male plants of *Coccoloba uvifera* growing in Loomis Park at Miami Beach, Florida. However, in this species the seed was either imperfectly formed in all the fruits sectioned or the fruit was hollow. Likewise these "male" fruits dehisced easily from the pedicels and rarely approached the size of the mature fertile fruits from the pistillate plants.

The habit of growth of the species of *Coccoloba* found in the West Indies has also led to confusion in the interpretation of the species and the formation of descriptions. Three growth habits can be observed in the field and can also be recognized on herbarium material. In one growth form, short shoots are produced. In these the branches are of determinate length with very short internodes. The short shoots may be terminal or lateral. The terminal short shoots frequently resume normal growth after a few seasons as short shoots and so the congested area of short compact internodes may be in the middle of a shoot of normal appearance.

The second form is the normal one, with vigorous shoots of uniformly elongated internodes. The third form is found in adventitious shoots which are produced when the original shoot is cut or damaged. These three forms are significant because of the different size and shape of the leaves produced on each. Adventitious shoots with extremely long internodes will have much larger leaves on larger petioles and with longer ochreae than those of the normal shoots. The leaves of short shoots are commonly smaller in these characteristics than those of the normal shoot. Because of the variation of leaf shape on a single plant, the shape of the leaf, particularly the nature of the leaf apex is not a good taxonomic character and where used must be considered with caution.

The large number of species described by Britton, Urban and Schmidt which I have reduced to synonymy in this paper are commonly based on

the failure of these men to recognize the condition of variant growth. The sterile Ekman specimens from Cuba which Schmidt referred to *C. longifolia*, a Jamaican species, are adventitious shoots of *C. diversifolia*. The species described by Schmidt as *C. lineari-lanceolata* is material from an adventitious shoot of *C. pallida*, and the species *C. pilonis*, *C. acutissima* and *C. woodfredensis* described by Urban and Britton are adventitious shoots or short shoots of *C. reflexa* of Lindau based on a Wright collection.

Once these peculiarities of *Coccoloba* are recognized the species appear more clear-cut and it is hoped that the genus may be completely clarified by the work which is now in progress.

Little described *Coccoloba* as "a large genus of about 130 species". Actually nearly 400 names have been published for this genus. The large genus has been divided into sections by Wright (Griseb. Cat. Pl. Cub. 62. 1866), Meisner (DC Prod. 14: 150-171. 1856) and Lindau (l.c.) in their work on the group. The section as defined by those authors in the original form are not acceptable today in view of our present knowledge of additional species from intermediate areas. The problem of subdividing this large genus will be considered in a later publication. For the present paper I am not dividing the genus although three of the sections recognized by Lindau are represented in the species which follow.

No attempt will be made in this paper to give other than the most important bibliographic references. For a complete list of important as well as casual references to any of the following species, Lindau's monograph of the genus *Coccoloba* (Engl. Bot. Jahrb. 13: 106-229. 1890) and his later paper in Urban, Symbolae Antillanae (1: 215-233. 1899) present most of the literature prior to 1900. Britton's earlier treatment of the genus *Coccolobis* in Cuba appeared in the Bulletin of the Torrey Botanical Club, 42: 365-371. 1915.

Coccoloba L. Syst. Nat. ed. 10, 1007, 1367. 1759.

Shrubs or trees; branches terete, often geniculate, or arranged in one plane, short shoots commonly developed laterally or the terminal shoots of limited growth becoming long shoots; nodes commonly tumid; ochreae characteristically developed, membranaceous or coriaceous, deciduous or persistent, glabrous, puberulent or pilose; leaves alternate, minute to large, membranaceous, chartaceous or coriaceous, the margin entire to undulate, flat or revolute, the primary veins straight to the margin, much branched at the apex becoming reticulate or arcuate and anastomosing or arcuate and bifurcate-anastomosing, the secondary venation obscure or coarsely to minutely reticulate, the upper leaf surface commonly pitted, rarely pubescent, the lower leaf surface glabrous to pilose, short multicellular glands present or the glands depressed in the lamina producing resinous secretions; petioles terete to stout, broadly and shallowly canaliculate above, pilose to glabrous, the base often tumid, attached at the base of the ochreae or above the base to two-thirds the length of the ochreae; plants dioecious or monoecious; inflorescence racemose or sub-spicate, terminal on the primary or lateral branches, few flowered and short to

many flowered and several times the length of the leaves, the rhachis glabrous, puberulent, pilose or with glandular excretion; flowers unisexual, the staminate flowers in clusters of 2-5 at each node of the inflorescence, occasionally solitary, the pistillate flowers solitary; bracts subtending each node, the flowers developing in a membranaceous sheath which ruptures irregularly becoming an ochreola, the ochreolae membranaceous, 1 per flower, rarely stalked, the flowering pedicels shorter than the ochreolae to many times as long, the flowers articulated at the apex of the pedicel; perianth campanulate at the base forming a hypanthium, the lobes 5, imbricate, the outer three slightly larger than the inner, the stamens 7 or 8 borne on the hypanthium, the filaments united at the base, the anthers introrse, the stamens in the pistillate flowers rudimentary; pistil rudimentary in the staminate flowers, trigonous in the pistillate flower, the styles 3, dilated at the apices, the ovary 1 celled, the ovule solitary, attached basally; perianth expanding in fruit, the lobes surrounding the achene or the hypanthium expanding surrounding the achene with the perianth lobes appressed against the apex of the achene or coronate on the achene, the achene with a hard shiny outer layer, the inner layer papery; seed with ruminated endosperm, the major lobes 3, the minor lobes and involutions numerous, the embryo centrally located, the cotyledons orbicular, flat rarely folded, the radicle small, terete.

TYPE SPECIES: *Polygonum uvifera* L.

KEY TO THE SPECIES

- A. Perianth lobes investing the achene; leaves usually membranaceous; ochreolar sheath commonly elongating with the flowers; bracts usually black.....1. *C. venosa*.
- AA. Hypanthium investing the achene, the perianth lobes appressed against the apex of the achene or coronate on the achene; leaves coriaceous or chartaceous (membranaceous in *C. tenuifolia*); ochreolae not elongating with the flowers but broken early; bracts usually straw colored or brown.
 - B. Inflorescence short, 1-5 flowered, only rarely equalling the leaves; leaves 1-1.5 cm. long.
 - C. Leaves emarginate at the apex, cordate at the base, turning black on drying.....2. *C. microphylla*.
 - CC. Leaves spinose-mucronate or rigidly acuminate at the apex, turning dark but not black on drying.
 - D. Leaves cordate-ovate, the base strongly cordate, the apex long spinose.....3. *C. armata*.
 - DD. Leaves ovate to suborbicular, the base rounded to subcordate, the apex rigidly acuminate, not long spinose....
 -4. *C. geniculata*.
- BB. Inflorescence several to many flowered, elongate, 2.5-30 cm. long, shorter than the leaves to several times as long as the leaves.
 - C. Leaves spinose tipped or rigidly acuminate; leaf blades ovate to oblong, glabrous; rhachis of the inflorescence puberulent; pedicels slightly surpassing or twice the length of the ochreolae in fruit.....5. *C. reflexa*.

- CC. Leaves acute, acuminate, rounded or emarginate, not spinose or rigidly acute at the apex.
- D. Leaves persistently pubescent, at least below.
- E. Leaves puberulent on both surfaces; veins straight to the margin not anastomosing.....6. *C. Clementis*.
- EE. Leaves glabrous above, persistently pubescent below.
- F. Leaves orbicular, generally umbonate; veins straight to the margin, not anastomosing; pedicels shorter than the ochreolae; rhachis, bracts and ochreolae pilose.....7. *C. Acuña*.
- FF. Leaves ovate, oblong or elliptic, flat not umbonate; veins arcuate and anastomosing near the margin.
- G. Ochreolae pedicellate, borne at the apex of stout stalks; leaves white pubescent below, the blade turning black on drying.....8. *C. caesia*.
- GG. Ochreolae sessile; leaves not turning black on drying.
- H. Mature flowering pedicels or those of the fruit shorter than the ochreolae; leaves pale puberulent below, the hairs blunt at the apex.....9. *C. pallida*.
- HH. Mature flowering pedicels or those of the fruit exceeding the ochreolae; hairs attenuate at the apex.
- I. Flowering and fruiting pedicels 7-15 mm. long; leaves thick coriaceous; pedicels and flowers bright red....10. *C. coriacea*.
- II. Flowering and fruiting pedicels 1-3 mm. long; pedicels brown or tan; flowers greenish white.
- J. Leaves thin coriaceous, persistently pubescent below on the entire lamina; petioles arising from the base of the ochreae; inflorescence 2.5-3.5 cm. long.....11. *C. retirensis*.
- JJ. Leaves membranaceous, barbate in the axils of the veins, glabrate on the lamina; petioles arising from above the base of the ochreae; inflorescence 8-18 cm. long.....12. *C. tenuifolia*.
- DD. Leaves glabrous below when mature (rarely puberulent when young).
- E. Leaves orbicular to reniform, rounded or emarginate at the apex.
- F. Fruiting pedicels shorter than the ochreolae; perianth lobes coronate in the fruit, equaling the fruit in length; fruit pilose..13. *C. baracoensis*.

- FF. Fruiting pedicels exceeding the ochreolae; perianth lobes shorter than the fruit, coronate or appressed; fruit glabrous.
 - G. Rhachis of inflorescence keeled below the nodes; leaves thick coriaceous, the secondary venation obscure; fruit oblong, the perianth lobes not coronate.....14. *C. nipensis*.
 - GG. Rhachis of inflorescence terete or angled, not keeled.
 - H. Leaves broader than long, thick coriaceous, not turning black on drying; fruit obpyriform.....15. *C. uvifera*.
 - HH. Leaves thin coriaceous or chartaceous; fruit ovoid, perianth lobes more or less coronate.
 - I. Leaves coarsely reticulate veined on both surfaces, turning black on drying.
 - J. Rhachis of inflorescence puberulent; primary veins of the leaves free to the margin.....16. *C. Northropiae*.
 - JJ. Rhachis of inflorescence glabrous; primary veins of the leaves arcuate, anastomosing near the margin..17. *C. retusa*.
 - II. Leaves smooth above, finely reticulate below, not turning black on drying; inflorescence puberulent; veins anastomosing near the margin.....18. *C. praecox*.
- EE. Leaves ovate, oblong, elliptic but not orbicular.
 - F. Rhachis puberulent to pilose.
 - G. Fruiting pedicels shorter than the ochreolae or only slightly exceeding them.
 - H. Inflorescence stout, 10-30 cm. long; leaves thick coriaceous, generally more than 10 cm. long.
 - I. Veins of the leaves straight to the margins; perianth red, puberulent..19. *C. Shaferi*.
 - II. Primary veins arcuate, anastomosing near the margins; perianth white, glabrous.....20. *C. costata*.
 - HH. Inflorescence slender, 2-6 cm. long; leaves thin coriaceous, generally less than 7 cm. long.
 - I. Fruit obovoid, the lobes appressed against the apex of the achene; secondary venation reticulate on both surfaces, leaves commonly with

- glandular excretions resembling pel-
tate scales on the lower surface....
.....21. *C. benitensis*.
- II. Fruit ovoid, the perianth lobes more
or less coronate; leaves smooth, not
reticulate above, without noticeable
glandular excretions.
- J. Leaves smooth on both surfaces,
the lamina thin coriaceous, not
rigid, the apex acute to obtuse
but not mucronate; petioles
pilose; pedicels of the fruit
shorter than the ochreolae.....
.....22. *C. rufescens*.
- JJ. Leaves smooth above, minutely
reticulate below, the lamina usu-
ally rigidly coriaceous, the apex
acute or acuminate, commonly
short spinose mucronate; peti-
oles puberulent; fruiting pedi-
cels equal to or rarely half again
as long as the ochreolae.....
.....5. *C. reflexa*.
- GG. Fruiting pedicels 2-10 times as long as the
ochreolae.
- H. Leaves broader than long, thick coria-
ceous, without conspicuous reticulate
venation.....15. *C. uvifera*.
- HH. Leaves longer than broad; secondary
venation reticulate, at least below.
- I. Mature leaves 3-5 cm. long, oblong-
ovate to orbicular.
- J. Primary veins straight and free
to the margins, the leaf blades
usually turning black on drying,
shining above, commonly reticu-
late on both surfaces.....
.....16. *C. Northropiae*.
- JJ. Primary veins arcuate, dichot-
omous and anastomosing near
the margin, the leaf blades not
turning black on drying, smooth
above, minutely reticulate below.
- K. Leaf apex rounded or
emarginate; perianth lobes
imbricate, appressed
against the apex of the
achene....18. *C. praecox*.
- KK. Leaf apex acute to acumi-
nate, often spinose mu-
cronate; perianth lobes

- more or less coronate....
5. *C. reflexa*.
- II. Mature leaves 8–25 cm. long.
- J. Leaves membranaceous, commonly barbate in the axils when mature; petioles attached above the base of the ochreae.....
12. *C. tenuifolia*.
- JJ. Leaves coriaceous, glabrous; petioles attached at the base of the ochreae.
- K. Fruiting pedicels 8–15 mm. long.....10. *C. coriacea*.
- KK. Fruiting pedicels 3–5 mm. long.
- L. Leaves conspicuously coarsely reticulate on both surfaces, the blade with glandular excretions below.....
23. *C. Wrightii*.
- LL. Leaves smooth or minutely reticulate on both surfaces; glands usually sunken, excretions not evident.
- M. Leaf blades smooth
 ..20. *C. costata*.
- MM. Leaf blades minutely reticulate.
 15a. *C. uvifera*
 × *diversifolia*.
- FF. Rhachis glabrous or with glandular excretions.
- G. Rhachis and flowers with glandular excretions appearing as scales or peltate protuberances.
- H. Perianth lobes coronate in fruit, the fruit 7–9 mm. long; leaf blades with small glandular excretions below.....
23. *C. Wrightii*.
- HH. Perianth lobes appressed to the apex of the achene.
- I. Leaf blades ovate, cordate or rounded and unequal at the base, apex rounded or obtuse; glands sunken in pits or depressed; fruit fusiform, 10 mm. long or longer....24. *C. Leonardii*.

- II. Leaf blades oblong, narrowed at the base, acute to acuminate at the apex; glandular excretions appearing as peltate scales; fruit ovoid to globose, to 6 mm. long.....21. *C. benitensis*.
- GG. Rhachis and flowers glabrous.
 - H. Fruiting pedicels shorter than the ochreolae.
 - I. Primary veins straight to the margin; leaf blades thick coriaceous; petioles glabrous.....19. *C. Shaferi*.
 - II. Primary veins arcuate, anastomosing near the margin; leaf blades thin coriaceous.
 - J. Fruit ovoid, the perianth lobes coronate; petioles pilose pubescent25. *C. Swartzii* f. *pubescens*.
 - JJ. Fruit fusiform, the perianth lobes appressed and imbricate against the apex of the achene; petioles glabrous.....24. *C. Leonardii*.
 - HH. Fruiting pedicels longer than the ochreolae.
 - I. Leaves bullate, cordate auriculate at the base; flowers red on pedicels 5 mm. long; fruiting pedicels 10 mm. long.....26. *C. Cowellii*.
 - II. Leaves flat; flowers green or white.
 - J. Leaf blades cordate at the base, minutely reticulate on both surfaces; flowering pedicels 7-10 mm. long; fruiting pedicels to 15 mm. long...10. *C. coriacea*.
 - JJ. Leaf blades rounded or narrowed at the base, not cordate.
 - K. Leaves shining above when dry, usually turning black on drying; fruit ovoid, the perianth lobes coronate, the fruit to 6 mm. long.....17. *C. retusa*.
 - KK. Leaves dull, dark but not black on drying; fruit globose to obpyriform, the perianth lobes appressed against the apex of the achene, the mature fruit 10-13 mm. long.....27. *C. diversifolia*.

1. *Coccoloba venosa* L. Syst. Nat. ed. 10, 1007. 1759; Fawcett and Rendle, Jour. Bot. 51: 123. 1913.

Coccoloba punctata L. Sp. Pl. ed. 2, 523. 1762.

Uvifera arbor americana, fructu aromatico punctatus, Pluk. Alm. 394. t. 237, fig. 4. 1696, as to leaf only.

Coccoloba nivea Jacq. Hist. Stirp. Amer. 115, pl. 78. 1763; Enum. Pl. 19. 1762.

Guaibara venosa (L.) House, Am. Midl. Nat. 8: 64. 1922, (as *Guaibara*).

Trees to 10 m. tall; branches terete, glabrous, the nodes not tumid; ochreae membranaceous, deeply cleft, acuminate on one side, or truncate, to 2 cm. long, glabrous or with flattened glands; leaf blades oblong-lanceolate to elliptic, the apex short acuminate, the base narrowed and slightly cordate or cuneate or obtuse, 8×4 , 10×4.5 , 16.5×6.5 , 21×9 , 27×10.5 cm. long and broad, membranaceous, glabrous except for clusters of hairs in the axils of the veins, sparsely glandular below; midrib and primary veins slightly prominent on both surfaces, the primary veins 8–13 pairs, straight or arcuate, bifurcate and anastomosing at the margins, the petioles 5–10 mm. long, glabrous; leaves of the adventitious shoots about the same size, the internodes much elongate and the ochreae to 4 cm. long; inflorescence terminal or terminal on short lateral branches, the rhachis puberulent, angular; staminate flowers in clusters of 2–5, the pistillate flowers solitary, the bracts lanceolate-ovate, to 1.5 mm. long, black, puberulent to pilose or commonly with a fringe of hairs at the apex; ochreolae membranaceous, enlarging with the expanding bud, each flower with an ochreola, to 2 mm. long, the flowering pedicels 1–2 mm. long, glabrous; hypanthium less than 0.5 mm. long, the perianth lobes broadly ovate, 1.5–2 mm. long and broad, slightly unequal, the fertile stamens to 1 mm. long; fruiting pedicels 1.5–2.5 mm. long, the fruit broadly ovoid, the perianth lobes fleshy, white or pink enclosing the black achene, the hypanthium scarcely evident in the fruit, the fruit 3–4 mm. long and broad.

DISTRIBUTION: Cuba (introduced), Hispaniola, Puerto Rico, Jamaica, Virgin Islands, Lesser Antilles, Trinidad.

CUBA: Las Villas: Atkins Garden, Soledad, P. I. 98831 collected by Walsingham without number (G). In flower and fruit Nov. and March.

The history and synonymy of this species is quite confused. Fawcett and Rendle did considerable work in publishing their note on this species for the Flora of Jamaica. While *C. nivea* Jacq. has a clear-cut description and is well illustrated and might well be selected as the type, I am following Fawcett and Rendle's interpretation since it is now widely accepted in the Caribbean area. Lindau was completely confused in his treatments of *C. punctata*, *C. excoriata* and *C. venosa* and his work is difficult to untangle.

The specimen from Cuba is an introduction now under cultivation at the Atkins Garden at Soledad. The records of the garden list this as a plant introduced by the United States Department of Agriculture with

the number 98831 from Great Inagua in the Bahamas. There are no specimens of this species from the Bahamas in the collections I have studied and either the place of origin of this cultivated material is confused or the specimen might be growing in the Bahamas, also under cultivation, without herbarium records available.

According to correspondence with H. G. Walsingham of the Atkins Garden there is but one specimen in the Garden. That tree flowers and fruits regularly. From field studies made of other species I have concluded that the genus *Coccoloba* consists of dioecious plants; however, this specimen from Cuba must be monoecious. The majority of the ten herbarium specimens I have for study from the Soledad plant are with staminate inflorescences and flowers. On four specimens the flowers are perfect and have developed fruit. No truly pistillate flowers were seen in this collection.

The fruits of *C. venosa* are extremely attractive with the white or pink fleshy perianth lobes surrounding a jet black achene. Jamaica has been assumed the type locality of this species although, as Fawcett and Rendle point out, no collections are known from that island.

2. *Coccoloba microphylla* Griseb. Cat. Pl. Cub. 62. 1866.

Uvifera microphylla O. Ktze. Rev. Gen. 2: 561. 1891.

Virgate shrub 1–2 m. tall to small tree 5 m. tall, branches often arranged in one plane, commonly with brown shredding bark, the youngest branches puberulent, nodes not at all tumid; short shoots well developed, often spine-like at the tips; ochreae subcoriaceous, 1 mm. long, puberulent, commonly dehiscent from the side opposite the petiole and remaining attached to the petiole, appearing as auriculate wings; leaf blades orbicular to reniform, apex emarginate, base slightly cordate, 1×1 , 5×5 mm. long and broad, coriaceous, turning black on drying, venation reticulate, conspicuous on both surfaces; inflorescence terminal on short shoots, rhachis very short, flowers appearing sessile; bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, less than 0.5 mm. long, flowering pedicels 0.5 mm. long, hypanthium less than 0.5 mm. long, perianth lobes 1 mm. long and broad, fertile stamens 1 mm. long; fruiting pedicels less than 1 mm. long, fruit not known.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sierra de Nipe, at Rio Piloto, *Ekman 15069* (S); Gamboa, *Ekman 14996* (A, FM, G, NY, S, US). Matanzas: Pan de Matanzas, SE of Canasí, *Ekman 16513* (S); E. of Canasí, Cuabal del Espinal *Leon 12975* (NY). Las Villas: Cieneguita, *Combs 725* (FM, G, MO, NY, US); San Marcos, *Wright 2249* (type collection, G, MO, NY, S), *Leon 9187* (NY); Motembo, *Leon, Edmund & Fortún 8554* (NY), *Leon & Laustalot 11368* (NY). Pinar del Rio: Coloma, *Britton, Britton & Gager 7023* (NY), *Roig & Fors 4214* (NY). Isle of Pines: Siguanea, *Britton, Britton & Wilson 15376* (NY, US), *Ekman 12183* (US). Collected in flower: Feb., Aug., Sept. Local name: *uverillo*.

3. *Coccoloba armata* Griseb. Cat. Pl. Cuba 62, 283. 1866; Sauvalle, Fl. Cub. 139. 1868; Britton, Bull. Torrey Bot. Club 42: 366. 1915.

Uvifera armata O. Ktze. Rev. Gen. 2: 561. 1891.

Much branched shrub 1–3 m. tall becoming a tree 10 m. tall; branches commonly in one plane, puberulent, nodes slightly tumid; ochreae 1 mm. long, commonly breaking free on the side away from the petiole; leaf blades cordate, apex rigid, long spinose mucronate, base cordate, 5×4 , 12×9 mm. long and broad, coriaceous, glabrous, midrib impressed above, primary veins inconspicuous, upper surface smooth, lower surface minutely reticulate, margin slightly erose or entire, flat or recurved; petioles 1 mm. long, base tumid or corky, leaves of adventitious shoot 18×18 mm. long and broad; flowers in short terminal inflorescence, 2 or 3 flowers clustered together, rhachis very short or none, bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, 0.5 mm. long, flowering pedicels less than 0.5 mm. long, perianth yellow-white, hypanthium less than 0.5 mm. long, perianth lobes 1 mm. long and wide, fertile stamens 1 mm. long; fruiting pedicels less than 1 mm. long; fruit ovoid, narrowed at both ends, to 5 mm. long, 4 mm. in diameter, red, mature perianth lobes appressed against the apex of the achene, achene dark brown or black.

DISTRIBUTION: Cuba.

CUBA: Oriente: Guantnamo Bay, Britton 1974 (NY); La Carbonera, Guantnamo, Ekman 2878 (FM, S, US), Ekman 10170 (A, S); Sierra de Nipe, near Rio Piloto, Ekman 9993 (S); Bay of Sagua, Tánamo, Linden 1857 (BR). Las Villas: Motembo, Leon, Edmund & Fortún 8556 (NY), Leon & Roca 8205 (NY); Mordazo, Leon & Cazañas 5975 (NY); Calicita, Loma de Ciego, Combs 531 (FM, G, MO, NY, US); Rio San Juan, Britton, Earle & Wilson 5890 (NY); Manacas, Howard 5503 (G). Havana: Madruga, Leon & Cesàire 8956 (NY); Loma Coca near Campo Florida, Ekman 13217 (S); Miñas, Ekman 13140 (NY, S). Pinar del Rio: Sierra de Viñales, Ekman 16587 (S); Cabañas Bay, Ekman 10930 (NY, S); San Marcos, Wright 2250 (G, MO, NY, S, US, type Collection). Collected in flower: May, Aug., Nov. Collected in fruit: Jan., Aug., Sept., Nov., Dec.

The original description of this species in Cat. Pl. Cuba lists Wright 1250 as the specimen upon which the species is based. This is corrected in the emended list of Wright collections (l.c. 288) to read Wright 2250.

Field studies on this species are much needed. There are two aspects to the leaves of herbarium specimens. In some the leaves are smooth, in others minutely reticulate on both surfaces. In addition the plants of these two divisions have a slightly different appearance. At present there is no satisfactory way of handling these two divisions and all are cited as one species.

The majority of the specimens cited above are sterile. The flowers are small and the almost complete absence of an inflorescence axis adds to the difficulty of selecting flowering or fruiting material in the field.

4. *Coccoloba geniculata* Lindau, Engl. Bot. Jahrb. 13: 141. 1890.

Uvifera geniculata O. Ktze. Rev. Gen. 2: 561. 1891.

Virgate shrub, 1–2 m. tall; branches commonly short, contorted or geniculate, the youngest puberulent, nodes slightly tumid, ochreae cylindrical, membranaceous, oblique at the apex, 2–3 mm. long, leaf blades ovate to suborbicular, often umbonate, apex acute, commonly with a spiny mucro, base rounded, 1.5×1 , 2.5×1.5 , 3×2.5 cm. long and broad, coriaceous, glabrous, smooth often shining above, dull beneath, midrib impressed above, prominent below, primary veins 9–11 pairs, inconspicuous, secondary venation obscure, leaf surface glandular dotted above and below, margin entire, recurved; petioles 2–4 mm. long, puberulent or papillose, tumid at the base; leaves of adventitious shoots ovate, 4×2 cm. on petioles 5 mm. long; inflorescence terminal, often clustered, 0.5–1.5 cm. long, rhachis papillose rarely minutely puberulent, staminate flowers in clusters of 3–8, female flowers solitary, female inflorescence short, generally consisting of 1–3 flowering nodes; bracts membranaceous, 1.5–2.5 mm. long, 2–3 mm. broad, glabrous; ochreolae membranaceous, several concentrically arranged, flowering pedicels to 1 mm. long, perianth pink, hypanthium 0.5 mm. long, perianth lobes 1.5 mm. long and broad, filaments of fertile stamens less than 1 mm. long; fruit from a staminate plant ovoid, 5 mm. long, 2.5 mm. diameter, glabrous, perianth lobes appressed against the apex of the achene.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sabana de Yaba, Yareyal, Holguin, *Leon* 15783 (NY). Camaguey: Santayana, *Ekman* 15339 (A, FM, NY, S); Caobilla, *Acuña* 8876 (R. #4029, S. V. #8876, Herb. C. E. Baker #13700). Las Villas: Santa Clara city, *Ekman* 14042 (S), 16331 (S), 18842 (NY, S), *Leon* 14950 (NY), *Britton & Cowell* 10199 (NY), 13325 (NY), *Britton*, *Britton & Wilson* 6189 (NY); Puerto Principe, *Wright* 2255 (G, NY, MO, HABA, type Collection). Collected in flower: Feb., Mar., June, July, Oct. Collected in fruit: July.

Unfortunately the specimen (*Wright* 2255) on which Lindau based this species consists of adventitious shoots or fast growing shoots with larger leaves, and an abnormal inflorescence. Lindau's use of the specific epithet *geniculata* refers to the angular path of this abnormal inflorescence. It could, however, apply as well to the commonly geniculate nature of the branch system of the more typical plants now assigned to the species. The specimens collected by *Britton & Cowell* 13325 and *Britton*, *Britton & Wilson* 6189 show the relationship between the normal short shoot geniculate type of growth and the occasional adventitious shoot with the larger leaves.

In the plants with more normal growth habit than the type collection the inflorescence is short, rarely exceeding 1 cm. in length. Three to eight staminate flowers are clustered in concentric ochreolae as in the *Wright* specimen but the flowering axis is much shorter. In the female plants I have examined the flowering axis is likewise very short and may consist

of only three nodes with a total of three flowers, one per node of the rhachis.

The fruit mentioned in the description above was one of two fruits attached to the specimen collected by *Ekman 15339*. This specimen has staminate flowers on the plant but as occasionally happens the ovary may develop and apparently a mature fruit is produced. In this case, as in many cases I examined in the field, the fruit was hollow, with no evidence of an embryo and endosperm being formed. The shape and size of this fruit may be regarded as indication of that of fertile fruits. This conclusion is based on evidence obtained from the study of other fruits of similar abortive nature from other species studied in the field.

5. *Coccoloba reflexa* Lindau, Engl. Bot. Jahrb. 13: 141. 1890.

Coccoloba pilonis Urb., Fedde Repert. Sp. Nov. 13: 445. 1914; Schmidt, Fedde Repert. Sp. Nov. 32: 79. 1933.

Coccolobis woodfredensis Britton, Bull. Torrey Bot. Club 42: 367. 1915.

Coccoloba acutissima Urb., Fedde Repert. Sp. Nov. 18: 113. 1922.

Uvifera reflexa O. Ktze. Rev. Gen. 2: 562. 1891.

Shrub 1–2 m. tall; branches terete often geniculate, puberulent when young, nodes slightly tumid; ochreae membranaceous, puberulent 2–5 mm. long; leaf blades ovate to ovate-elliptic or oblong, rarely lanceolate, apex abruptly acuminate, often spinose mucronate, base rounded to slightly cordate, 4×2 , 5.5×2.5 , 7×4 , 8×3 cm. long and wide, coriaceous, smooth and shining above, dull beneath, glabrous except for the puberulent midrib, primary veins 5–7 pairs straight to arcuate anastomosing, inconspicuous, secondary venation reticulate below, blade punctate glandular dotted on both surfaces, margin entire, commonly recurved; petiole 3–6 mm. long, puberulent; inflorescence terminal, 2.5–8 cm. long, rhachis puberulent, staminate flowers in clusters of 2–5, pistillate flowers solitary, bracts ovate, 0.5 mm. long, ochreolae membranaceous, 0.5 mm. long, flowering pedicels 0.5–1 mm. long, hypanthium 0.5 mm. long, perianth lobes 1–1.3 mm. long and broad, fertile stamens 1 mm. long; fruiting pedicels 0.8–1.2 mm. long, fruit black, ovoid, to 6 mm. long, 3 mm. diameter, perianth lobes appressed against the apex of the achene.

DISTRIBUTION: Cuba.

CUBA: Oriente: Loma Pilon near Holguin, *Shafer 1232* (type collection of *C. pilonis*, NY, US), *Ekman 3289* (S); Cerro de Fraile, Holguin, *Ekman 7582* (S), *Ekman 15716* (S); Sabana de la Yaba, Yareyal, *Leon 15702* (NY); Sierra de Nipe, Rio Piloto, *Ekman 2718* (S), *19149* (S), *19162* (S), *2237* (type collection of *C. acutissima*, S); Loma Mensura, Sierra de Nipe, *Ekman 9733* (S); Cabeza de Nipe, Sierra de Nipe, *Ekman 2479* (S); Bio-Trail, Sierra de Nipe, *Ekman 4787* (S); ridge between Rio Bayate and Rio Piedra, Sierra de Nipe, *Ekman 15035* (S); Woodfred to Piedra Gorda, Sierra de Nipe, *Ekman 15255* (S), *Shafer 3180* (type collection of *C. woodfredensis*, NY); Punta Padre, *Curbelo 109* (NY); Playa Vaca, Moa, *Acuña 12408* (SV). Without locality: *Wright 2256* (type collection of *C. reflexa*, G, MO, HABA). Collected in flower: July, Aug., Sept. Collected in fruit: July, Aug., Sept., Oct., Nov., Dec.

Schmidt pointed out in his paper in Fedde, Rep. 32: 79. 1933, that the present collection of specimens represents the extremes of a species with variable leaf shapes. In doing so Schmidt reduced *C. woodfredensis* and *C. acutissima* to the synonymy of *C. pilonis*. Unfortunately Schmidt did not look far enough, for *C. reflexa* of Lindau based on a Wright collection (2256) represents the same species and being an older name must be used for this species.

Again the variation in the leaves can be associated with the growth habit of the plant, the larger and narrowed leaves of the type of *C. acutissima* are vigorous shoots while the smaller leaves represent a more normal growth pattern. All types of leaves can be found on one or a few sheets of the same collection. The large number of collections from the vicinity of Holguin and from Sierra de Nipe indicate the range of variation to be expected in one species in one area.

As Schmidt correctly points out the amount of puberulence on the rhachis of the inflorescence varies considerably from specimen to specimen. Also the characters Britton used to separate *C. woodfredensis* and *C. pilonis* in his revision of the genus *Coccoloba* (Bull. Torrey Bot. Club 42: 365. 1915) are entirely variable and can not be used.

6. *Coccoloba Clementis*, sp. nov.

Frutex ramulis teretibus, nigrescentibus exsiccis, puberulis, ochreis brunneis, membranaceis, puberulis, petiolos 6–8 mm. excedentibus, unilateraliter perincisis, apice dilatatis; lamina matura obovata vel elliptica, apice rotundata, basi acuta vel rotundata, chartacea, supra et subtus persistente puberula et glandulosa, 5×3.5 vel 6×4 cm. longa et lata, margine undulato maturitate recurvato, nervo medio supra subconspicuo, nervis primariis supra inconspicuis, nervo medio et venis subtus prominentibus, nervis primariis 3–5, ad marginem rectis, non anastomosantibus, venis secundariis obscuris; petiolis 3–5 mm. longis, supra subcanaliculatis, puberulis; inflorescentia terminalis 5–12 cm. longa, rhachi dense puberulo, bracteis late ovatis plus minusve 0.5 mm. longis, 1.5–2 mm. latis, puberulis, brunneis, membranaceis, ochreolis circa 0.5 mm. longis, puberulis, pedicello puberulo ochreolas non excedente; floribus masculinis 2 vel 3 per nodulum puberulis, hypanthio 1 mm. longo, lobis 5, imbricatis, exterioribus 1.5×1 mm. longis et latis, interioribus sub-brevioribus, staminibus 7 vel 8, filamentis plerumque 1 mm. non aequantibus antheris circa 0.5 mm. longis; pistillo rudimentario ad 1 mm. longo, stylis 3; flos foemina et fructus ignotus.

CUBA: Oriente: Rio Cromita, Cayaguain, Punta Gorda, *Clemente* 4097 (TYPE, G; ISOTYPE, HAB).

The specimens cited above were collected in flower on July 25th. The species is distinct from others from the West Indies in the undulate leaf margin and the persistent puberulence on both leaf surfaces.

7. *Coccoloba Acuña*, sp. nov.

Frutex ramulis teretibus, pilosis; nodis tumescentibus; ochreis membranaceis, pilosis, 2–4 mm. longis, ad basin cylindricis, ad apicem sursum

dilatatem et obliquis; lamina orbiculare, bullata, apice rotundata, basi rotundata, 1.5×1.5 , 2×2 cm. longa et lata, coriacea, supra glabra, nitida, subtus pilosa, nervo medio et venis primariis supra impressis vel obscuris, nervis primariis 4 vel 5, ad marginem rectis, bifurcatis, non anastomosantibus, venis secundariis subtus dense reticulatis; petiolis teretibus, 3–4 mm. longis, pilosis; inflorescentia terminalis, 2–4 cm. longa, rhachi piloso, bracteis ovatis, 1.5 mm. longis, 1.5–2 mm. latis, pilosis; ochreolis membranaceis, 1 mm. longis, pilosis, pedicellis ochreolas non excedente; floribus masculinis 2 vel 3 per nodulum, hypanthio 0.5 mm. longo, lobis ovatis, 1 mm. longis, 1 mm. latis, staminibus 8, filamentis 0.5–1 mm. longis, pistillo rudimentario; floribus foemineis 1 per nodulum, perianthio masculinis similibus, staminibus rudimentariis, pistillo 1 mm. longo; fructu ovoideo, nigro, glabro, ad 8 mm. longo, 4 mm. diametro, lobis perianthii coronatis, 1 mm. longis.

CUBA: Oriente, Breñales de Playa Vaca, Moa, *Acuña 13094* (SV), *Clemente 4104* (TYPE, G; ISOTYPE, HAB). Collected in flower: Nov. Collected in fruit: July.

This species resembles *C. baracoensis* in having orbicular leaves but can be distinguished by the umbonate character of the leaf blade, the pubescence on the lower surface of the leaf and the glabrous fruits. It also resembles the small leaf forms of *C. geniculata* from which it is distinct on the pubescence of the leaf and the long inflorescence.

8. *Coccoloba caesia* Ekman ex Schmidt, Fedde Repert Sp. Nov. 24: 74. 1927.

Small tree; branches terete, glabrous, nodes not tumid; ochreae membranaceous, 6–8 mm. long, glabrous, turning black on drying; leaf blades elliptical, rarely ovate-elliptical, apex rounded, base narrowed commonly oblique, 9×3.5 , 13×4 , 17×6.5 cm. long and broad, subcoriaceous, turning black on drying, margin entire, slightly recurved, midrib and veins slightly prominent above, prominent below, primary veins 8–12 pairs, arcuate anastomosing, secondary venation reticulate, conspicuous above, obscured below by club shaped papillae arising from the epidermal cells giving the lamina a gray or ashen appearance; petioles 8–12 mm. long, glabrous, arising from the middle of the ochreae; inflorescence terminal, solitary or with a smaller spike at the base, 12–19 cm. long, rhachis slightly puberulent, staminate flowers in clusters of 2 or 3, pistillate flowers solitary, bracts broadly ovate, less than 0.5 mm. long, puberulent, ochreolae borne on stout puberulent stalks 1–1.5 mm. long in the staminate flowers, 2–3 mm. long in the pistillate flowers, ochreolae membranaceous, puberulent, pedicels not evident, hypanthium less than 0.5 mm. long, the perianth lobes ovate, 1.5 mm. long, filaments of fertile stamens 1.5–1.8 mm. long; fruit obovoid, 8 mm. long, 4–5 mm. broad, narrowed at the base, lobes of the perianth appressed against the apex of the achene.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sierra de Nipe, Loma Mensura, *Ekman 9894* (TYPE, S; ISOTYPES, G, NY); near Rio Piloto, *Ekman 3351* (FM, S), 6420

(NY, S); Baracoa, Lomas de Cuaba, *Ekman 4237* (S); Sierra Maestra, edge of Arroyo Corajo near Nagua, *Ekman 14739* (FM, NY, S); Loma del Gato, *Clemente 3681* (HAB); Florida Blanca, Santiago de Cuba, *Bucher 231* (NY, R). Collected in flower: May, Oct., Nov. Collected in fruit: Jan.

The stalked ochreolae characterize this species which is also distinct on the gray pubescence of the lower leaf surface. The type specimen is staminate.

9. *Coccoloba pallida* Wr. in Griseb. Cat. Pl. Cub. 61. 1866.

Coccoloba lineari-lanceolata Schmidt, Fedde Repert. Sp. Nov. **24**: 76. 1927.

Uvifera pallida O. Ktze. Rev. Gen. **2**: 561. 1891.

Shrub or small tree to 7 m. tall; branches terete, papillose or puberulent, short shoots conspicuously developed, ochreae membranaceous, 1–2 mm. long, puberulent to pilose; leaf blades ovate to elliptic-ovate, apex rounded or obtusely acuminate, base rounded to obliquely cordate, 4×2 , 5.5×3.5 , 6.5×2 , 9.5×6 cm. long and broad, coriaceous, glabrous and pitted above, minutely and densely white papillose below, the hairs short and blunt with rounded apices, midrib and primary veins impressed above, prominent below, primary veins 5–8 pairs, straight or arcuate, bifurcate and anastomosing near the margin, secondary venation densely reticulate on both surfaces; petioles 1–4 mm. long, puberulent attached above the base of the ochreae; leaves of adventitious shoots ovate-lanceolate to lanceolate-oblong, 11×3 , to 19×4 cm. long and broad, petioles 3–4 mm. long, ochreae 3–8 mm. long; inflorescence terminal, 3.5–6.5 cm. long, rhachis puberulent, staminate flowers in clusters of 2–4, pistillate flowers solitary, bracts ovate, less than 0.5 mm. long, puberulent, ochreolae membranaceous, spreading, to 1 mm. long, puberulent; flowering pedicels less than 0.5 mm. long; hypanthium less than 0.5 mm. long, perianth lobes 0.5–1 mm. long and broad, fertile stamens less than 1 mm. long; fruiting pedicels less than 0.5 mm. long; fruit ovoid, to 7 mm. long, 3.5 mm. thick, perianth lobes appressed against the apex of the achene.

DISTRIBUTION: Cuba.

CUBA: Matanzas: Matanzas City, *Ekman 17211* (type Collection of *C. lineari-lanceolata*, S). Havana: Jibacoa beach, *Leon 13248* (G). Pinar del Rio: Cajalbana, *Ekman 10488* (S), *Leon 4945* (NY); San Marcos, *Wright 2254* (type collection, G, HABA, MO, NY, S); Loma Pelada, Cayajabos, *Leon 13221* (NY), *13545* (NY), *13812* (G, HAB, NY). Collected in flower: Dec. Collected in fruit: Jan., Mar. Common names: *Uvero blanco*, *Uverillo*.

Schmidt's statement that *Coccoloba lineari-lanceolata* is distinct from all other West Indian species of *Coccoloba* is evidence he did not recognize the character of adventitious shoots and the accompanying variation of leaf form that is characteristic of the genus *Coccoloba*. The Ekman collection which is the type of *C. lineari-lanceolata* is of vigorous shoots probably adventitious in nature. Ekman noted on the collector's label that the specimen was rare in Matanzas where he collected it. The char-

acteristic pubescence of *C. pallida* and the striking venation pattern as well as the high attachment of the petiole on the ochreae allow this sterile collection to be placed in *C. pallida*.

10. *Coccoloba coriacea* Sagra, Fl. Cub. 11: 184. 1853; Lindau, Engl. Bot. Jahrb. 13: 153. 1890.

Uvifera coriacea O. Ktze. Rev. Gen. 2: 561. 1891.

Coccoloba calobotrys Meisner, DC. Prod. 14: 157. 1856.

Shrub to slender tree 7 m. tall; branches terete, stout, puberulent at the nodes, often of determinate growth (short shoots) with several concentric ochreae at the base, nodes not tumid; ochreae membranaceous, 4–7 mm. long, short pilose pubescent; leaf blades elliptic-lanceolate to oblong-lanceolate, apex acuminate, often with rigid tip, base rounded to cordate, 11×4 , 13×6 , 17×2.5 , 21×9 cm. long and broad, coriaceous, glabrous, midrib and veins flat above, conspicuous below, primary veins 5–7 pairs arcuate, bifurcate and anastomosing near the margin, secondary venation minutely reticulate on both surfaces; petioles 5–8 mm. long, puberulent to glabrate; leaves of adventitious shoots 19×6 , 21×9 cm. long and broad; inflorescence terminal, 10–27 cm. long, rhachis papillose to puberulent; staminate flowers commonly single, occasionally in clusters of 2 or 3 flowers, pistillate flowers solitary; bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, 0.5 mm. long; flowering pedicels 7–10 mm. long, glabrous, perianth red, glabrous, hypanthium 1 mm. long, perianth lobes ovate, 2 mm. long, 1.5 mm. broad, fertile stamens 1 mm. long; fruiting pedicels to 15 mm. long, fruit ovoid, acuminate at both ends, to 7 mm. long, 5 mm. thick, perianth lobes sub-coronate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sierra de Nipe, Piedra Gorda to Woodfred, *Shafer* 3543 (NY, US); Rio Canapé, *Ekman* 9593 (S); Bio-Trail, *Ekman* 4778 (NY, S); Pico Turquino, *Acuña* 10075 (SV); Enseñada de Mora, *Britton, Cowell & Shafer* 13003 (FM, MO, NY, US); Nagua, Mucural Hill, *Leon* 11031 (NY); Rio Yara, *Ekman* 14158 (S); 14841 (S); Mayari, *Wright* 2258 (G, HABA, MO). Pinar del Rio: Loma de Cajalbana, *Ekman* 10487 (NY, S); Cajalbana, *Leon & Charles* 4932 (NY). Havana: Vuelta de Abajo, *Sagra* 544 (fr.), 290 (fl.) (NY). Collected in flower: Mar., April, July, Aug., Sept.

A specimen collected by Ramon de la Sagra in Havana Province and found in the Meisner herbarium at the New York Botanical Gardens is the type of *Coccoloba calobotrys* Meisner. Two packets are in the corners of this sheet labelled *Sagra* 544 (fr) and *Sagra* 290 (fl). The specimen according to the label was from the DeCandolle Herbarium and may well be a fragment of the specimen mentioned by Sagra in the original description. *Coccoloba calobotrys* Meisner therefore may well be based on the same specimen as *C. coriacea* Sagra. The numbers may have been assigned to the specimens after the publication of the Flora of Cuba.

This species is difficult to distinguish from *C. costata* in sterile condition.

11. *Coccoloba retirensis* sp. nov.

Arbor parva ramulis teretibus, dense ferrugineo-pilosis; ochreis cylindricis, coriaceis, dense ferrugineo-pilosis, 3–5 mm. longis; lamina oblonga vel elliptica, apice acuta, basi rotundata, 5.5×2.5 , 7×3.5 , 9×4 cm. longa et lata, coriacea, supra glabra, subtus dense pilosa, nervo medio et venis primariis supra inconspicuis, subtus prominentibus, venis primariis 5–7, arcuatis, prope marginem bifurcatis, anastomosantibus, venis secundariis supra et subtus dense reticulatis, margine vix recurvato; petiolis 5–8 mm. longis, pilosis; inflorescentia terminalis, 2.5–3.5 cm. longa, ad basem plures ochreas pilosas gerens, rhachi dense piloso, bracteis ovatis, 0.5 mm. longis, 1 mm. latis, pilosis, ochreolis membranaceis, ad 1 mm. longis, pedicello piloso, 1–1.5 mm. longo; floribus foemineis 1 per nodulum, glabris, hypanthio 0.5 mm. longo, lobis 5, imbricatis, 1.5 mm. longis, 1–1.5 mm. latis, staminibus rudimentariis, ad 1 mm. longis, pistillo 2 mm. longo, stylis 3; floribus masculinis et fructu ignotis.

CUBA: Pinar del Rio, Santa Cruz de los Pinos, Retiro, *Ekman 18614* (TYPE, S).

Collected in flower March 5, 1924. Ekman's collectors label bears the abbreviation "cult." The specimen cited is not referable to any species from the Caribbean, Central or South America now known to me and so I assume the plant may have been under cultivation as a shade tree and is native to Cuba.

12. *Coccoloba tenuifolia* L. Syst. Nat. ed. 10. 1007. 1759, Amoen. 5: 397. 1760; Fawcett and Rendle, Jour. Bot. 51: 124. 1913.

Coccoloba jamaicensis Lindau, Engl. Bot. Jahrb. 13: 206. 1890.

Uvifera jamaicensis O. Ktze. Rev. Gen. 2: 561. 1891.

Coccoloba leptostachyoides Lindau, Engl. Bot. Jahrb. 13: 207. 1890.

Uvifera leptostachyodes O. Ktze. Rev. Gen. 2: 561. 1891.

Coccolobis? frutescens etc. Browne, Hist. Jam. 210, pl. 14, fig. 3. 1756.

Coccolobis bahamensis Britton, Bull. N. Y. Bot. Gard. 4: 116. 1905.

Shrub or small tree to 5 m. tall; branches terete, puberulent, becoming short shoots often well developed, nodes slightly tumid; ochreae membranaceous above, coriaceous and persistent below, to 15 mm. long, puberulent; leaf blades elliptical, apex short acuminate, base narrowed, unequally rounded to subcordate, 3.5×2 , 7×4.5 , 9.5×6 , 12×10 cm. long and wide, membranaceous, subcoriaceous, glabrous above, finely puberulent below, tomentose in the axils of the primary veins and often extending onto the secondary venation or the blade, midrib and primary veins flat or impressed above, prominent below, primary veins 4 or 5 pairs, arcuate, anastomosing, secondary venation finely reticulate; petioles 6–9 mm. long, persistently puberulent, attached above the enlarged base of the ochreae; inflorescence terminal 8–18 cm. long, weak and pendent, rhachis puberulent; staminate flowers 1–4 in a cluster, pistillate flowers solitary, bracts broadly ovate, less than 0.5 mm. long, puberulent, ochreolae membranaceous about 0.5 mm. long, puberulent; flowering pedicels 1–2 mm. long; hypanthium 0.5–1 mm. long, perianth lobes 1–1.5

mm. long and broad, filaments of fertile stamens 1 mm. long, rudimentary stamens of pistillate flowers less than 0.5 mm. long; fruiting pedicels 1–2 mm. long, fruit ovoid to globose, 5–6 mm. long, 4 mm. thick, perianth lobes appressed to the apex of the achene.

DISTRIBUTION: Jamaica, Cuba, Bahamas. Type from Jamaica.

CUBA: Oriente: S. of Niguero between Rio Nuevo and the coast in limestone based forests. *Ekman 16152 (S)*.

The specimen collected by Ekman was unidentified in the Stockholm herbarium. Unfortunately it is a sterile specimen collected Jan. 16, 1923. It can be referred without question to this species, previously unreported from Cuba since *C. tenuifolia* is readily identified by the puberulent, membranaceous leaves and the characteristic attachment of the petiole to the ochreae sheath.

Lindau listed *Coccoloba tenuifolia* L. among the uncertain species at the end of his monograph. The specimen in the Linnaean herbarium is an excellent flowering specimen, however, and is readily determinable. Fawcett and Rendle review this situation in Jour. Bot. 51: 124. 1913 and refer *C. jamaicensis* and *C. leptostachyoides* of Lindau to the synonymy of *C. tenuifolia* L.

Coccolobis bahamensis of Britton must likewise be referred to the synonymy of *C. tenuifolia* L. The Bahama material is abundant and while most of the leaves are in the small end of the size range cited in my description above the species does not merit varietal status.

13. *Coccoloba baracoensis* Schmidt, Fedde Repert. Sp. Nov. 24: 73. 1927.

Small tree; branches terete, ferruginous pilose-pubescent, nodes not tumid; ochreae cylindrical, membranaceous, pilose, 1–3 mm. long, deeply cleft opposite the petiole; leaf blades orbicular, apex rounded, base slightly cordate, 2.5×2.5 , 4.5×4.5 , 8.5×6.5 cm. long and broad, coriaceous, glabrous, smooth and shining above, minutely reticulate and densely glandular below, margin entire, slightly recurved, midrib and primary veins inconspicuous above, slightly prominent below, primary veins 3–5 pairs, arcuate and becoming reticulate near the margin, not prominently anastomosing; petioles 4–5 mm. long, pilose; inflorescence terminal, 6–14 cm. long, rhachis striate, pilose, staminate flowers not known, pistillate flowers solitary, bracts ovate, 1–1.5 mm. long, pilose, ochreolae membranaceous, flaring, pilose, 1 mm. long, flowering pedicels less than 1 mm. long, perianth pilose, hypanthium less than 1 mm. long, perianth lobes 1.5 mm. long, 1 mm. broad, stamens rudimentary, less than 0.5 mm. long, pistil 1–1.5 mm. long; fruiting pedicels shorter than the ochreolae, fruit globose and crowned by long attenuate perianth lobes, densely pilose, fruit 3 mm. diameter, the perianth lobes 3 mm. long, achene smooth, shining, golden in color.

DISTRIBUTION: Cuba.

CUBA: Oriente: Baracoa, Lomas de Cuaba, *Ekman 4297 (TYPE, S;*

ISOTYPE, NY); Sierra Azul, *Ekman 4427a* (S). Collected in flower and fruit in January.

14. *Coccoloba nipensis* Urban, Fedde Repert. Sp. Nov. 13: 445. 1914.

Coccoloba uviferiella Lundell, Contrib. Univ. Mich. Herb. 6: 12. 1941.

Shrub to tree, 10 m. tall; branches terete, glabrous, nodes tumid, ochreae membranaceous, tightly cylindrical, 6–8 mm. long; leaf blades orbicular to elliptical, oval or rarely sub-obovate, apex rounded or slightly emarginate, base cordate, rounded or rarely narrowed, 3×2 , 3×3 , 4×4 , 5×4 cm. long and wide, coriaceous, glabrous, smooth above and below, densely glandular pitted below; midrib and primary veins flat to obscure above and below, primary veins 4 or 5 pairs, evident only near the midrib, margin entire; petioles 3–8 mm. long, glabrous, tumid at the base; inflorescence terminal 6–9 cm. long, rhachis glabrous, strongly keeled below the bracts and flowers; staminate flowers solitary or in clusters of 2 or 3, pistillate flowers solitary, bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, 0.5 mm. long, glabrous, flowering pedicels 1–2 mm. long, hypanthium less than 0.5 mm. long, perianth lobes 0.5–1 mm. long and broad, fertile stamens less than 1 mm. long; fruiting pedicels to 4 mm. long, divaricate at a sharp angle from the rhachis, fruit oblong, rounded at both ends, to 8 mm. long, 5 mm. thick, perianth lobes appressed against the apex of the achene.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sierra de Nipe, Woodfred, *Shafer 3565* (type Collection, FM, G, MO, NY, US); Rio Piloto, *Ekman 15188* (FM, S), *19168* (S); Sierra de Nipe, *Ekman 9963* (A, NY); Loma Minqura, *Shafer 3815* (FM, MO, NY, US); Rio Joa, Baracoa, *Ekman 3661* (S); Moa, *Mrs. Bucher 44* (NY), *45* (NY), *101* (TYPE of *C. uviferiella*, NY, MICH), *Victorin & Clemente 21712* (G), *Howard 5953* (G), *Mrs. Bucher* without number (SV #11106); Playa de Moa, *Clemente, Chrysogone & Nestor 4327* (G), *Leon & Clemente 23273* (G); Cayo Chico near Moa, *Acuña 13093* (SV). Collected in flower: May, June, July. Collected in fruit: July, Sept.

Lundell describing *C. uviferiella* reports "this species suggests the common sea grape *C. uvifera* to which it is allied." Apparently Lundell overlooked the description of *C. nipensis* published 27 years earlier and the specimens in the New York Botanical Garden cited above. *Coccoloba uviferiella* is a perfect match for *C. nipensis* and the species must be placed in synonymy.

A note in Britton's handwriting in the herbarium in the New York Botanical Garden reports the type specimen of this species to be in Berlin. Since that specimen is presumably destroyed I consider the specimen at NY to be the new type specimen since it is in the best condition of the isotypes cited above.

15. *Coccoloba uvifera* L. Syst. Nat. ed. 10, 1007. 1759.

Polygonum Uvifera L. Sp. Pl. 365. 1753.

Guaiabara Uvifera (L.) House, Am. Midl. Nat. 8: 64. 1922.

Tree of strand areas, 2–15 m. tall, branches terete, stout, papillose to pilose, nodes not tumid, ochreae rigid coriaceous at the base, membranaceous at the apex, 3–8 mm. long, papillose to pilose; leaf blades orbicular to reniform, apex rounded, truncate or emarginate, base rounded to broadly cordate, one lobe often extending around the petiole, 6×8 , 11×13 , 13×18 cm. long and broad, thick and fleshy when fresh, coriaceous when dry, glabrous and minutely punctate on both surfaces, midrib and primary veins prominent on both surfaces, frequently brightly colored when fresh, primary veins 3–5 pairs, usually straight, bifurcate and weakly anastomosing near the margin, commonly barbate in the axils of the basal veins, secondary venation minutely reticulate or obscure; petioles stout, 7–10 mm. long, papillose to pilose; leaves of adventitious or fast growing shoots usually variable in size and shape commonly obovate; inflorescence stout, 15–30 cm. long, rhachis puberulent; staminate flowers in clusters of 1–7, pistillate flowers solitary, bracts ovate, 1–1.5 mm. long, 2 mm. broad, puberulent, ochreolae membranaceous, 1 mm. long, puberulent, flowering pedicels 1–2 mm. long, perianth yellow-white or greenish, hypanthium 2–3 mm. long, perianth lobes 4 mm. long, 3–4 mm. wide, fertile stamens to 4 mm. long; fruiting pedicels 3–4 mm. long, fruit obpyriform, 1.2–2 cm. long, 8–10 mm. diameter, narrowed at the base, rounded truncate at the apex, the perianth lobes appressed against the apex of the achene, perianth rose-purple when mature, the achene black.

DISTRIBUTION: Along shores, Florida, Bermuda, through the Caribbean to S. America.

CUBA: Oriente: Gibara to Punta Hicacos, *Shafer* 1485 (US, NY); Santiago, *Taylor* 324 (NY). Las Villas: Soledad, *Jack* 585 (A), 4118 (A), 4533 (A), 5092 (A), 5319 (A); Rancho Luna, E. of Cienfuegos Bay, *Howard* 4209 (G); Castillo de Jagua, *Combs* 569 (G, FM, MO, NY). Havana: *Liebmann* without number (C, several sheets); Morro Cojimar, *Ekman* 372 (S); Playa de Marianao, *Palmer & Riley* 852 (US); Rancho Bayeros, *Wilson* 1339 (C); Santiago las Vegas, *A. L. & H. N. Moldenke* 19915 (NY); Playa Mariano, *Van Hermann* 887 (NY). Camaguey: Cayo Sabinal, *Shafer* 1125 (US, NY). Isle of Pines: Nueva Gerona, *Curtis* without no. (NY). Without locality: *Wright* 2259 (G). Collected in flower: Mar., April, Aug., Sept. Collected in fruit: June, July, Aug. Common names: *uva*, *uva de la caleta*, *uvero*, *uva de playa*.

15a. *Coccoloba uvifera* L. \times *C. diversifolia* Jacq., hybr. nov.

Shrub or tree; branches terete, minutely pilose; ochreae coriaceous, persistent, oblique and flaring at the apex, pilose; leaf blades oblong to obovate-oblong, apex rounded to sub-acute, base obliquely rounded to obliquely cordate, 11×8 , 14×9.5 , 16×10.5 cm. long and broad, coriaceous, midrib and primary veins prominent on both surfaces, secondary venation conspicuously reticulate both surfaces, primary veins 5–7 pairs, arcuate, anastomosing, leaf blade glabrous above, crispate pilose on midrib and veins below and in axils of veins and on lamina parallel to midrib, densely resinous glandular below; petiole stout, 1–1.5 cm. long,

minutely pilose; inflorescence terminal 7–15 cm. long, rhachis puberulent, bracts broadly ovate 1 mm. long, puberulent, ochreolae membranaceous, 1 mm. long, puberulent, flowering pedicels 1.5–2 mm. long, puberulent; staminate flowers in clusters of 2–3, hypanthium 0.5 mm. long, perianth lobes 0.5–1 mm. long, stamens 1 mm. long; pistillate flowers not seen; fruiting pedicels 2–4 mm. long, fruits not seen.

CUBA: Pinar del Rio: Sta. Cruz de Los Pinos, *Ekman* 18615 (S), Range, *Roig* 11935 (SV).

In the nature of the pubescence, the texture of the leaves and the pattern of primary venation this material approaches *C. uvifera*. The secondary venation and the type of glands found on the leaves are similar to those of *C. diversifolia*. The shape of the leaf blade is intermediate between these two species. *Coccoloba uvifera* apparently hybridizes freely with many other species of the same genus. Unfortunately single collections in the herbarium are usually of little value in the study of possible hybridization and field studies are needed with just this idea in mind.

16. *Coccoloba Northropiae* Britton, Bahama Flora 117. 1920, (as *Coccolobis*).

Coccoloba leoganensis var. *parvifolia* Griseb. Cat. Pl. Cub. 61. 1866.

Coccoloba retusa Lindau, Engl. Bot. Jahrb. 13: 150. 1890, in part.

Shrub or small tree to 4 m. tall; branches terete, pilose becoming glabrate, nodes slightly tumid; ochreae membranaceous, 2–3 mm. long, glabrous; leaf blades orbicular to obovate or elliptic, apex rounded, obtuse or emarginate, base narrowed, 3×2.5 , 4×3 cm. long and wide, thinly coriaceous, glabrous, turning black on drying, commonly shining above, dull beneath, midrib and primary veins equally prominent on both surfaces, secondary venation reticulate, primary veins 4–6 pairs, straight, diffuse branching and becoming reticulate near the margin, not arcuate and anastomosing, margin entire, flat; petioles 3–5 mm. long, short pilose pubescent; leaves of adventitious shoots variable in shape, 5×3 , 6×4 cm. long and wide on petioles to 7 mm. long; inflorescence terminal 5–7 cm. long, rhachis puberulent, the female more so than the male, bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, less than 0.5 mm. long; male flowers in clusters of 2, female flowers solitary, flowering pedicels 0.5–1 mm. long, hypanthium 1 mm. long, perianth lobes 1 mm. long and wide, fertile stamens less than 1 mm. long, stamens of pistillate flowers rudimentary, less than 0.5 mm. long; fruiting pedicels 1.5 mm. long, fruit ovoid, to 5 mm. long, 3 mm. thick, perianth lobes appressed against the apex of the achene.

DISTRIBUTION: Cuba, Bahamas. (Type collection, *Curtis* without number from New Providence, Bahamas).

CUBA: Oriente: Santiago de Cuba, *Ekman* 19206 (S); San German, *Ekman* 6346 (S); Loma Estrella, Sierra de Nipe, *Ekman* 6392 (S). Pinar del Rio: Morillo, *Ekman* 17376 (S); Viñales, Sierra de Viñales, *Ekman* 18037 (NY, S); Sierra de Pendejeral, groupa del Rosario; Sierra de Organos, *Ekman* 17525 (S). Without location: *Wright* 2251 (G,

HABA, MO, S). Collected in flower: Mar., May, June, July. Collected in fruit: Sept. Local name: *uverillo*.

Both Lindau and Grisebach have misinterpreted *C. retusa* by including *Wright 2251* in that species. The puberulence of the plant and the character of the venation of the leaves make this Wright specimen, and the other specimens cited above, clearly distinct from *C. retusa*. This represents the first report of *C. Northropiae* from Cuba.

17. *Coccoloba retusa* Griseb., Cat. Pl. Cub. 61. 1866; Lindau, Engl. Bot. Jahrb. 13: 150. 1890, in part.

Uvifera retusa O. Ktze. Rev. Gen. 2: 562. 1891.

Coccoloba retusa forma *acuminata* Lindau, Engl. Bot. Jahrb. 13: 151. 1890.

Coccolobis colomensis Britton, Bull. Torrey Bot. Club 42: 369. 1915.

Shrub 1–2 m. to tree 17 m. tall; branches terete, glabrous, nodes slightly tumid, ochreae membranaceous, 5–9 mm. long, glabrous; leaf blades ovate, oblong, elliptic or obovate, apex acute, rounded or emarginate, rarely acuminate, base narrowed, rounded or subcordate, commonly unequal, 3.5×2.5 , 7×5.5 , 10×4 cm. long and broad, coriaceous, glabrous, shining above, turning black on drying, midrib and primary veins prominent on both surfaces, primary veins 4–7 pairs, straight towards the margin bifurcating and anastomosing near the margin, secondary venation reticulate, conspicuous both surfaces, margin entire or undulate; petioles 6–10 mm. long, glabrous; inflorescence terminal, 4–14 cm. long, rhachis glabrous, staminate flowers solitary or in clusters of 2–4, pistillate flowers solitary, bracts ovate, less than 0.5 mm. long, ochreolae membranaceous less than 0.5 mm. long, flowering pedicels developing after the flower opens, i.e. flowers sessile at the apex of the inflorescence, or on pedicels 0.5 mm. long near the base, hypanthium 0.5 mm. long, perianth lobes 0.5–0.7 mm. long and broad; fertile stamens less than 1 mm. long; fruiting pedicels 0.5–1 mm. long, fruit ovoid, rounded at the base, to 6 mm. long, 3 mm. thick, perianth lobes coronate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Loma del Gato, *Leon, Clemente & Roca 10269* (NY), *Leon 12363* (NY), *Acuña 9820* (SV), *Crisostomo 3329* (G); Sierra de Nipe, Rio Jimbambay, *Ekman 15138* (G, S); Rio Piloto, *Ekman 4748* (A, NY, S), *5014* (S), *5794* (NY, S), *6415* (FM, MICH, S), *6691* (A, S), *9767* (NY, S), *9790* (MO, S); Rio Piedra, *Ekman 9817* (NY, S); Nagua on Rio Yara, *Ekman 14840* (A, FM, NY, S, US); Cayo del Rey, *Ekman 4793* (S); Papayo near Sevilla, *Ekman 9462* (A, FM, G, MO, NY, S, US); Bayate near Cauto, *Ekman 6192* (MICH, S); Arroyo del Cristo, S. of Nagua, *Ekman 14754* (FM, NY, S); Charco Largo, Punta Padre, *Curbelo 281* (NY); Bayate near Arroyo Piedra, *Ekman 4668* (S); Manacal, Sierra Maestra, *Ekman 9358* (MICH, S); El Paraiso, Holguin, *Ekman 7607* (S); Santiago, *Clemente 4242* (HAB); Mucural Hill, near Nagua, *Leon 11034* (NY); Rio Seboruco to falls of Rio Mayari, *Shafer 3688* (G, NY, US); Jagueyes de Mulas, *Roig 14* (NY); Facallores, *Wright 1668* (type Collection of *C. retusa* f. *acuminata*, G), *Wright 2252* (G, HABA,

MO, NY, S, type Collection *C. retusa*, see discussion). Las Villas: Cieneguita, *Combs* 374 (FM, G, MO, NY); Savana de Motembo, *Leon*, *Fortún & Edmund* 8568 (NY); Cayo Ramones, Jucaro Quemado, Peninsula de Zapata, *Roig & Cremata* 2255 (FM); Sabana de Manacas, Laguna Asiento Viejo, *Leon* 9283 (NY); Central Australia, Peninsula Zapata, *Ekman* 18328 (S); Lomas de Banao, *Luna* 110 (NY); El Porvenir to Aguacate, *Britton & Wilson* 5361 (NY); Mina Carlotta, Sierra de San Juan, *Howard* 5628 (G), 5661 (G). Havana: Loma de la Pita, San Miquel, *Leon*, *Ekman*, *Johnston*, & *Roig* 9101 (NY), *Leon* 11529 (NY); Loma de Neponuiceno, San Miquel de Casanova, *Leon* 11601 (NY); Campo Florida at Rio Quezada, *Ekman* 13237 (A, FM, NY, S, US). Pinar del Rio: Loma Pelada, Cayajabos, *Leon & Roig*, 13538 (NY), 13539 (NY), *Leon* 13205 (NY); Coloma, *Britton*, *Britton & Gager* 7037 (NY, US, type Collection of *C. colomensis*), *Ekman* 17828 (NY, S), *Britton & Cowell* 9848 (G, NY, US); Sabalo, Rio Sabalo, *Ekman* 11447 (NY, S); Savannas SE of Los Palacios, *Leon & Roca* 7368 (NY); Los Palacios to San Juan de Zayas, *Shafer* 1813 (NY); Rio Blanco, *Ekman* 17294 (S). Isle of Pines: Rio Las Casas, Nueva Gerona, *Ekman* 12005 (S), 12010 (S); Manati, *Blain* 185 (FM); Los Indios, *Britton*, *Britton & Wilson* 14243 (NY); Coe's Camp, Enseñada de Siguaná, *Britton & Wilson* 14846 (NY, US); Mal Pais to La Ceiba, *Ekman* 11915 (S); San Juan, *Roig & Cremata* 1783 (NY). Locality Unspecified: Herb. Sauvaille 2173 (HABA). Collected in flower: Feb., Mar., June, July, Aug., Sept., Oct., Dec. Collected in fruit: Jan., Feb., Sept., Oct., Nov., Dec. Local names: *uverillo*, *Cocuyo de la maestra*.

The numerous collections of *Coccoloba retusa* cited above show a tremendous range of variation in the size and shape of the leaves. Lindau described one form for the species but since this is just a small part of the normal variation of leaf shape it is not recognized as valid in this treatment.

Coccoloba colomensis which Britton based on a Britton & Gager specimen from Pinar del Rio is also separated by Britton on characters found in the shape of the leaf. Leaf shape is an unstable base for specific distinction in this genus and I am reducing Britton's species to synonymy of *C. retusa*.

The type collection of *Coccoloba retusa* is *Wright* 2252. I have seen six examples of this collection as cited above but in the packets attached to the sheets of the Gray Herbarium collection are a variety of notes regarding the location where the collection was made. These are "Monte Verde Sept. 7," "Potosi, Monte Yow, Oriente, Oct. 10," "Retin, Oct. 19." Thus the collection seems to be mixture. All of the material distributed under the number *Wright* 2252 however is referable to *C. retusa*.

18. *Coccoloba praecox* Wright ex Lindau, Engl. Bot. Jahrb. 13: 142. 1890.

Uvifera praecox O. Ktze. Rev. Gen. 2: 562. 1891.

Coccoloba Ekmani Urban, Fedde Repert. Sp. Nov. 14: 331. 1916.

Shrub to tree 9 m. tall; branches terete, nodes tumid, twigs puberulent when young becoming glabrate; ochreae membranaceous, puberulous, 4-6

mm. long; leaf blades ovate to oblong-ovate, apex acute with a mucro or rounded, occasionally slightly emarginate, base rounded to sub-cordate, 3×2.5 , 4.5×3.5 , 5×4.5 cm. long and broad, thin coriaceous to chartaceous, glabrous, upper surface smooth or minutely reticulate, lower surface minutely reticulate, midrib impressed above, slightly prominent below, puberulent, primary veins 5–7 pairs, inconspicuous, arcuate anastomosing near the margin, margin entire with a prominent edge, flat; petioles 4–8 mm. long, puberulent; leaves of adventitious shoots, ovate-oblong, rounded or emarginate at the apex, 5×5.5 cm. to 6.5×4.5 cm. long and broad; inflorescence terminal 2–9 cm. long, rachis puberulent, staminate flowers solitary or in clusters of 2 or 3, pistillate flowers solitary, bracts ovate less than 0.5 mm. long, puberulent, ochreolae less than 1 mm. long, flowering pedicels 0.5–1 mm. long, hypanthium 0.5 mm. long, perianth lobes 1–1.5 mm. long, fertile stamens with filaments 1–1.5 mm. long; fruiting pedicels 1–1.5 mm. long, fruit ovoid, 4 mm. long, 2.5 mm. thick, perianth lobes sub-coronate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Charco, *Wright* 2253 (type Collection, G, HABA, MO, NY, S); Punta Padre, *Curbelo* 74 (HAB, NY), *Roig* 5537 (NY); Mir, between Victoria de las Tunas and Holguin, *Ekman* 7541 (MO, S); Anafe, near Caimito del Guayabal, *Ekman* 188 (S). Camaguey: Camaguey City, *Britton*, *Britton & Cowell* 13115 (NY, US); Sabana de la Caridad, *Céspedes*, *Roig*, *Luaces & Aranzo* 910 (NY); Santayana, *Ekman* 19036 (S); Savana de Providencia, *Roig* 8209 (NY). Las Villas: Mordazo, *Leon* 9232 (NY), *Leon & Cazañas* 5929 (NY); Casilda, *Ekman* 18879 (S). Matanzas: Cuabal del Espinal, Canasí region, *Leon & Roig* 13354 (HAB, NY), 13355 (NY), *Acuña* 11290 (SV); Pan de Matanzas, *Ekman* 16510 (S). Havana: Cuabal de Salomon, Minas, *Leon* 13787 (NY), 13887 (NY); Cuabal de Jesús María, Minas, *Leon* 13334 (NY), 13335 (NY); Madruga, *Leon & Cesàire* 8940 (NY); Lomas de Jatas, Guanabacoa, *Ekman* 580 (type Collection of C. *Ekmani*, FM, S), 10905 (S), 16532a (S), 16532b (NY, S), *Leon* 7342 (NY, HAB); Loma Coca near Campo Florida, *Ekman* 13220 (S), 16437a (S), 16437b (A, S), 19005 (A, FM, MO, NY, S, US). Pinar del Rio: Mayari, S. of San Cristobal, *Fors* 4790 (NY). Collected in flower: Apr., May. Collected in fruit: Apr., May.

The type collection of *C. Ekmani*, (*Ekman* 580) was considered distinct on the ovate to suborbicular leaves however these minor variations in shape can be matched in many leaves of the original Wright collection. *Coccoloba Ekmani* is not a valid species.

19. *Coccoloba Shaferi* Britton, Bull. Torrey Bot. Club 42: 369. 1915, (as *Coccolobis*).

Coccoloba azulensis Schmidt, Fedde Repert. Sp. Nov. 24: 73. 1927.

Shrub or tree to 7 m. tall; branches terete, puberulent or papillose, contorted, short shoots, commonly developed with concentric ochreae, ochreae 7–9 mm. long, membranaceous, puberulent; leaf blades ovate to ovate-elliptic, rarely lanceolate-ovate, apex obtusely acuminate to rounded,

base cordate, 5×3 , 7×5.5 , 9×6 , 14×9 cm. long and wide, coriaceous, glabrous, dull both surfaces, midrib and primary veins slightly impressed above, prominent below, primary veins 5–7 pairs, straight to the margins, not arcuate nor anastomosing or rarely bifurcating close to the margin and reticulate, blades densely pitted on both surfaces, secondary venation reticulate slightly conspicuous both surfaces, margin entire, slightly revolute, petioles 7–10 mm. long, glabrous; leaves of vigorous or adventitious shoots lanceolate-ovate, apex acuminate, 12×3 to 14×4.5 cm. long and wide; inflorescence terminal 10–25 cm. long, rhachis, bracts, ochreolae and perianth papillose or puberulent, flowering pedicels shorter than the ochreolae, staminate flowers in clusters of 2–4 flowers, rarely solitary, pistillate flowers solitary, bracts ovate, 2 mm. long, ochreolae membranaceous, 2–3 mm. long, perianth red, hypanthium 2–3 mm. long, perianth lobes oblong, 3 mm. long, 2 mm. broad, fertile stamens 2 mm. long; fertile pistil 4 mm. long; fruit not known.

DISTRIBUTION: Cuba.

CUBA: Oriente: near mouth of Rio Yamanigüey, *Shafer 4252* (NY); Camp Toa to Camp La Barga, Northern Oriente, *Shafer 4165* (TYPE, NY); Sierra de Moa, *Ekman 4511* (S), *Bucher 104* (NY), *104a* (NY), *Shafer 8351* (NY), *Howard 6050* (G); Monte de la Brena, Sierra de Moa, *Leon, Clemente & Alain 22567* (G), *22582* (G), *Clemente & Crisostomo 4966* (G); Sierra Azul, *Ekman 4427b* (type collection of *C. azulensis*, S); Narave at Baracoa, *Ekman 4054* (NY, S). Collected in flower: Jan., Feb., Mar., Apr., July, Aug., Sept., Dec.

Following the original description of *C. azulensis* Schmidt reports his new species to be similar to *C. Shaferi* but differing in the longer inflorescence and the glabrous inflorescence rhachis. Apparently this comparison was made with the original description of *C. Shaferi* for the specimens of *C. Shaferi* cited above have inflorescences 10–20 cm. long instead of the 12 cm. originally reported by Britton. The pubescence of the inflorescence rhachis, bracts, ochreolae and perianths varies considerably from small protuberances of epidermal cells called a papillose puberulence to short pilose hairs. In all characters the Ekman specimen selected as the type of *C. azulensis* seems to grade into the larger collection of *C. Shaferi* and may be regarded as an extreme of variation. I have therefore reduced Schmidt's species to the synonymy of *C. Shaferi*.

20. *Coccoloba costata* Wr. ex Sauvalle, Fl. Cub. 139. 1868; Lindau, Engl. Bot. Jahrb. 13: 155. 1891; Schmidt, Fedde Repert. Sp. Nov. 27: 105. 1929.

Uvifera costata O. Ktze. Rev. Gen. 2: 561. 1891.

Coccoloba leoganensis var. *cordata* Griseb. Cat. Pl. Cub. 61. 1866.

Tree; branches stout, pubescent with a ferrugineous to golden pubescence; ochreae membranaceous, 4–6 mm. long, ferrugineous puberulent; leaf blades ovate to elliptic, apex obtuse, acute or obtusely acuminate, base obliquely cordate, 7×5 , 13×8 , 18×12 , 24×15 cm. long and broad, coriaceous, golden shining above, dull brown below, midrib and

veins impressed above, prominent below, primary veins 5-7 pairs, arcuate, anastomosing, blade pitted, glandular above and below, glabrous; petiole stout, 8-10 mm. long, slightly puberulent; leaves of adventitious shoots to 35×22 cm. long and broad, petioles 1.5 cm. long; inflorescence terminal, rhachis puberulent, 15-20 cm. long, staminate flowers in clusters of 2-4, pistillate solitary, bracts ovate, 0.5 mm. long, ochreolae membranaceous, 0.5 mm. long, flowering pedicels 0.5 mm. long, hypanthium 0.5 mm. long, perianth lobes 0.5-1 mm. long and broad, fertile stamens 1 mm. long; fruiting pedicels to 1.5 mm. long, fruit globose, to 6 mm. long, 3 mm. thick, perianth lobes coronate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Monte Verde, *Wright 1393* (G, HABA, MO, S, type Collection); Sierra de Nipe, Rio Piloto, *Ekman 2725* (FM, NY, S); Piedra Gorda to Woodfred, *Shafer 3084* (FM, G, NY, US); Arroyo del Medio, *Ekman 15243* (A, S); Loma Mensura *Ekman 3205* (S); Baracoa, Lomas de Cuaba, *Ekman 4229* (S); Moa, Leon, *Clemente & Alain 22518* (G), *Clemente 4360* (G); Punta Gorda, Sierra de Moa, *Clemente 4053* (G); Alta Loma Naranja, *Bucher* without number (SV #10099). Collected in flower: Jan., June. Collected in fruit: Aug., Oct. Common name: *uvilla*.

21. *Coccoloba benitensis* Britton, Bull. Torrey Bot. Club **42**: 370. 1915, (as *Coccolobis*).

Coccolobis monticola Britton, Bull. Torrey Bot. Club **50**: 37. 1923.

Coccolobis brevipes Britton, Bull. Torrey Bot. Club **42**: 371. 1915.

Shrub or small tree; branches terete, densely puberulent, commonly branching in one plane, nodes slightly tumid; ochreae 3-4 mm. long, membranaceous, densely ferrugineous pilose; leaf blades ovate to ovate-elliptic, apex acute to acuminate, base narrowed or rounded, 2×1 , 4×2 , 6.5×3.5 , 7.5×3 cm. long and wide, coriaceous, glabrous and pitted above, coarsely reticulate and glabrous below but densely to sparingly covered with peltate resinous exudate, margin entire, slightly recurved, midrib impressed above, slightly keeled when dry, primary veins 3 or 4 pairs, prominent both surfaces, secondary venation reticulate, conspicuous both surfaces; petioles 2-4 mm. long, flattened above, ferrugineous pilose on the upper surface, commonly covered with peltate resinous exudate below; leaves of adventitious shoots with ochreae 9-12 mm. long, blades to 10.5×5 cm. long and wide, petioles to 8 mm. long; inflorescence terminal or terminal on short shoots, 2-3 cm. long, several concentric ochreolae at the base, rhachis puberulent or with glandular exudate, bracts minute, less than 0.5 mm. long, ochreolae minute, less than 0.5 mm. long, flowering pedicels less than 1 mm. long; staminate flowers in clusters of 2 or 3, pistillate flowers solitary, hypanthium 1 mm. long, lobes 0.5 mm. long, filaments of staminate flowers 1 mm. long, in pistillate flowers 0.1 mm. long, rudimentary pistil in male flower 0.3 mm. long, pistil in female flowers to 3 mm. long; fruiting pedicels 1-1.5 mm. long, fruit ovoid to globose, 6 mm. long, 4 mm. thick, perianth lobes appressed at the apex of the achene, perianth of fruit commonly with glandular exudate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Camp San Benito, *Shafer 4049* (TYPE, NY), 4044 (FM, NY, US); Sierra de Moa, Camp la Gloria, *Shafer 8230* (NY, US); Sierra Maestra, Arroyo Jiménez, *Ekman 14802* (NY, S); Rio Yara and Rio Palmamocha, *Ekman 14331* (US, S), 14389 (A, FM, S); Pico Turquino, *Leon 10713* (type of *C. monticola*, NY), *Leon 10902* (NY); Sierra Maestra, Estribo Cardero, *Roig, Acuña & Bucher 6590* (NY); Arroyo Veinticinco *Wright 2257* (type Collection of *C. brevipes*, G, HABA, MO, NY). Collected in flower: July, Aug. Collected in fruit: Aug.

Britton failed to recognize the various patterns of growth found in specimens of *Coccoloba*. The presence of short shoots, vigorous growth, and adventitious shoots each with very different aspects and sizes of leaves, petioles and ochreae has led to numerous duplication of species descriptions. *Coccoloba benitensis* was chosen as the type and name of this group because the shoots are near the normal to be expected for the species and because the specimens have female flowers and fruit. The type specimen of *C. brevipes* Britton is described by Wright in field notes as a subscandent bush. This I judge to be vigorous shoots and the larger internodes, leaves, petioles and ochreae support this view. On the other hand the material of *C. monticola* is from a specimen which appears stunted but which possesses short shoots and has small internodes, leaves, etc. Britton was impressed with the peltate "black dots" on the lower leaf surface which are actually glandular excretions. These may be present on the upper or lower leaf surface of all specimens as well as on the rhachis of the inflorescence and on the perianth and the fruit. The amount of resinous exudate is frequently impressive.

22. *Coccoloba rufescens* Wr. ex Lindau, Engl. Bot. Jahrb. 13: 143. 1890.

Uvifera rufescens O. Ktze. Rev. Gen. 2: 562. 1891.

Coccoloba rufescens Wr. forma *longifolia* Lindau, l.c. 13: 143. 1890.

Coccoloba punctata var. *parvifolia* Griseb. Pl. Wright. 175. 1860.

Shrub or small tree, 2–4 m. tall; branches terete, nodes slightly tumid, youngest branches ferruginous pilose; ochreae cylindrical, 3–4 mm. long, cleft almost to the base, pilose; leaf blades ovate, elliptic or oblong-ovate, apex acute to acuminate, base narrowed, rounded, often oblique, 5×2.5 , 7.5×3 , 9×4 cm. long and broad, coriaceous, smooth above, usually shining, midrib and primary veins sub-prominent below, secondary venation obscure, lamina densely and minutely glandular punctate below; petioles 3–5 mm. long, pilose; inflorescence terminal, 2–6 cm. long, rhachis pubescent; staminate flowers unknown; pistillate flowers solitary, bracts broadly ovate, less than 1 mm. high, 2 mm. broad, pilose, ochreolae membranaceous 0.5 mm. long, strongly bilobed, pilose, pedicels shorter than the ochreolae, perianth white, glabrous, hypanthium 1–1.5 mm. long, lobes ovate, 1–1.5 mm. long, stamens rudimentary, pistil oblong triangular; fruit globose, 5×4 mm., slightly narrowed at apex and the base, perianth lobes coronate, 1.5–2 mm. long.

DISTRIBUTION: Cuba.

CUBA: Oriente: Mt. Verde, *Wright* 462 (type Collection, FM, G, MO, NY, S), *Wright* 1394 (FM, G, HABA, MO, NY, S); Baracoa, Lomas de Cuaba, *Ekman* 4220 (NY, S); Montes de la Breña, Moa, *Acuña* 13090 (SV), *Acuña* 13092 (SV); Camp Toro to Camp La Barga, *Shafer* 4152 (NY); Cayoquán, *Victorin & Clemente* 21519 (HAB); Sierra de Nipe, *Bucher* without no. (SV #11493). Without location: *Wright* 462a (G). Collected in flower: Feb., Apr. Common name: *uvero de costa*.

23. *Coccoloba Wrightii* Lindau, Engl. Bot. Jahrb. 13: 151. 1890;
Schmidt, Fedde Repert. Sp. Nov. 24: 27. 1927.

Uvifera Wrightii O. Ktze. Rev. Gen. 2: 562. 1891.

Coccolobis saxicola Britton, Bull. Torrey Bot. Club 50: 37. 1923.

Shrub or small tree, to 3 m. tall; branches terete, glabrous, ochreae membranaceous, 4–6 mm. long, puberulent to tomentose; leaf blades ovate, elliptic, obovate or rarely ovate lanceolate, apex acute to abruptly short-acuminate, base narrowed to obtuse, usually slightly oblique, 5×2.5 , 8×4 , 10×7 , 11×10 cm. long and broad, coriaceous, young leaves often shining above, mature leaves generally dull both surfaces, midrib and primary veins impressed above, the lamina commonly umbonate between the veins, primary veins 4–6 pairs, prominent below, arcuate, anastomosing near the margin, secondary venation reticulate, conspicuous on both surfaces, leaves glandular below, margin entire, slightly recurved; petioles 4–7 mm. long, papillose to puberulent; leaves of adventitious shoots to 20×17 cm. long and broad, petioles 2.5 cm. long, ochreae to 2 cm. long; inflorescence terminal, 3–10 cm. long, rhachis papillose with glandular excretions, staminate flowers in clusters of 2–5, pistillate flowers solitary, bracts ovate, 0.5 mm. long, ochreolae membranaceous 1 mm. long, papillose or glandular, flowering pedicels 1 mm. long, perianth greenish white, hypanthium 1 mm. long, perianth lobes 1–1.5 mm. long and broad, fertile stamens with filaments united below into a tube 1 mm. long, free portion of filaments 0.5 mm. long; fruiting pedicels 1–3 mm. long, fruit ovoid, slightly contracted at the base, rounded at the apex, 7–9 mm. long, 4–5 mm. diameter, perianth lobes slightly coronate.

DISTRIBUTION: Cuba.

CUBA: Oriente: Sierra Cristal, at Rio Lebisa, *Ekman* 6864 (NY, S); Sierra de Imías, crest of Puntón del Maté, *Leon* 12280 (G, NY); Manacal, Sierra Maestra, *Ekman* 9378 (A, NY, S); Cueva del Aura, Sierra Maestra, *Roig & Bucher* 6688 (NY), *Bucher* 171 (R, HAB); Loma del Gato, *Bucher* 259 (NY), *Leon*, *Clemente & Roca* 10167 (type Collection of *C. saxicola*, NY); Pico Turquino, Sierra Maestra, *Acuña* 7671 (R); Maestra Range, *Leon* 10712 (NY, R); Alto Loma del Naranjo, Baracoa, *Bucher* (R #1033, SV); Arroyo Jiménez, Sierra Maestra, *Ekman* 14785 (NY, S); Hongolosongo, Loma del Gato, *Clemente* 1815 (NY); Rio Yara and Rio Palmamocha divide, Sierra Maestra, *Ekman* 14386 (S); Loma Mensura, Sierra de Nipe, *Ekman* 9922 (NY, S); Monte Real, Sierra del Cobre, *Ekman* 7863 (S); Valley of Rio Yaminigüey, *Shafer* 4229 (NY, US); Monte de la Breña, Sierra de Moa, *Leon*, *Clemente & Nestor* 23325 (G); Punta Gorda, Sierra

de Moa, *Clemente* 4038 (G); Monte Grande de Centeno, *Leon, Clemente & Alain* 22664 (G); Charrascal del Coco, Sierra de Moa, *Leon, Alain & Chrysogone* 22631 (G); La Guinea, *Wright* 1395 (FM, G, MO, NY, type Collection). Las Villas: Lomas de Banao, *Luna* 468 (NY); El Purial and Los Guineos, Lomas del Banao, *Ekman* 16235 (S); Pico Potrerillo, Trinidad Mts., *Ekman* 18947 (S). Collected in flower: June, July, Aug. Collected in fruit: Jan., Mar., July, Aug., Oct.

This is a species of mountain areas, collected from 700–1100 meters altitude. Lindau described the type collection of *Wright* 1395 as flowering in June. The Wright material cited above which I have seen was collected Dec. 17, 1859 according to the label attached and the material is in fruit. Apparently this is another mixture of Wright labels.

24. *Coccoloba Leonardii*, sp. nov.

Arbor ad 10 m., ramulis teretibus, glabris, nodis vix tumescentibus, ochreis subcoriaceis, glabris, 3 mm. longis; lamina ovata, apice rotundata vel acuta, basi rotundata vel subcordata, lateribus inaequalibus, in petiolum subdecurrente, 6.5×4 , 8×5.5 , 11×7 cm. longa et lata, coriacea, glabra, supra cineracea, subtus brunnea, nervo medio et nervis primariis supra et subtus prominentibus, nervis primariis 5–7, arcuatis, anastomosantibus, venis secundariis reticulatis; petiolis 8–11 mm. longis, supra late canaliculatis, glabris; inflorescentia terminalis, 5.5–14 cm. longa, rhachi glabra, bracteis ovatis, 0.5–1 mm. longis, ochroleis membranaceis, 1 mm. longis, pedicello ochroleas non excedente; floribus masculinis 2–4 per nodulum, hypanthio 0.5 mm. longo, lobis 1.5 mm. longis et latis, filamentis ad 1 mm. longis, pistillo rudimentario circa 0.5 mm. longo, floribus foemineis perianthio masculinis similibus, staminibus rudimentariis, pistillo 1–1.5 mm. longo; fructu late fusiformi, 10×5 , 11×7 mm. longo et diametro, supra nigro, subtus brunneo, lobis perianthii subcoronato, 1 mm. longo.

DISTRIBUTION: Haiti, Cuba.

HAITI: Tortue Island: Tableland N.E. of Basse Terre, 30' tree in dry thickets in rocky ravines, *E. C. & G. M. Leonard* 12466 (TYPE, A; ISOTYPES, MO, NY, US); La Vallée, *E. C. & G. M. Leonard* 11335 (MICH, US), 11381 (A, G, K, US), 11421 (NY, US), 11423 (G, US); Pte. Petite Bois, *Ekman* 4150 (S). Navassa Island: West of the lighthouse, *Ekman* 10843 (S, US). Dept. du Nord: Morne la Vigie, Cap Haitien, *Ekman* 2706 (S, US); Bayeux, *Nash* 293 (FM, NY). Dept. du Nord-Ouest: Saline Michel near Port au Paix, *Ekman* 3931 (S).

CUBA: Oriente: Bayate, between Rio Bayate and Arroyo Bibano, *Ekman* 9003 (S), 9622 (S).

A new species readily distinct by the fusiform bicolorous fruit from others of the Antilles with sessile flowers and fruits.

This species is named in honor of its collector, E. C. Leonard of the Smithsonian Institution in Washington, D. C. who has a continuing interest in the flora of Hispaniola.

The two collections made by Ekman in the Oriente province of Cuba are both sterile adventitious shoots but they can be referred to this species

without question on the venation and glandular characters of the leaf blades.

25. *Coccoloba Swartzii* Meisner, DC. Prod. 14: 159. 1856.

Coccoloba neglecta Fawcett & Rendle, Jour. Bot. 51: 124. 1913.

Uvifera Swartzii O. Ktze. Rev. Gen. 2: 562. 1891.

Tree 8–20 m. tall; branches terete, glabrous, nodes slightly tumid; ochreae 10–12 mm. long, basal portion 3–5 mm. long, coriaceous, persistent, upper portion 5–7 mm. long, membranaceous, deciduous; leaf blades ovate to elliptic, apex acute, base narrowed, rounded or slightly cordate, 7×5 , 11×9 , 15×7.5 cm. long and broad, coriaceous, usually turning black on drying, glabrous, pit-like depressions on the upper surface, small glands on the lower surface, midrib and veins inconspicuous or flat above, prominent below, primary veins 6 or 7 pairs, arcuate anastomosing, secondary venation conspicuous, reticulate; petioles 10–18 mm. long, glabrous, attached at the base of the ochreae; inflorescence terminal, 10–15 cm. long, rhachis glabrous or with glandular exudate, rarely papillose, staminate flowers in clusters of 3–5 with tightly concentric ochreolae forming a truncate cylinder after the flowers have fallen, pistillate flowers solitary, ochreolae erect in flower, flattened against the rhachis in fruit, bracts ovate, 1–1.5 mm. long, ochreolae membranaceous 1–1.5 mm. long, flowering pedicels shorter than the ochreolae, hypanthium 0.5 mm. long, perianth lobes 1–1.5 mm. long, fertile stamens with filaments 1 mm. long; fruit ovoid, 8–10 mm. long, 6 mm. thick, perianth lobes 1–1.5 mm. long, coronate.

DISTRIBUTION: Jamaica, Hispaniola, Puerto Rico, Virgin Islands, St. Croix, Antigua, Montserrat, Guadeloupe, Martinique, St. Lucia, Barbados.

25a. *Coccoloba Swartzii* forma *pubescens*, forma nova.

A speciei ramis junioribus, petiolis, laminis ad basin, ochreis et rhachi inflorescentiae saltem at basin puberulis vel pilosis differt.

ANTIGUA: Sugar Loaf Mt., Box 1543 (US), 1544 (US); Blubber Valley, Box 1411 (TYPE, US), Orange Valley, Box 1184 (US).

BARBUDA: Martello Tower, John C. Beard 372 (A, MO); Codrington Village, Fairchild 3830 (A, US), Box 602 (US).

GADELOUPE: De Ponthieu 86 (FM).

CUBA: Oriente: Punta Padre, Curbelo 224 (NY). Local name: *uvillon* (Cuba).

The significance of pubescence in the genus *Coccoloba* has not received any attention by the earlier monographers. I can do little in interpreting the variations in pubescence with the material on hand but it is hoped within the course of this study to have large collections from single plants and uniform populations to determine what variations are to be expected within one plant, within the species and to determine what factors cause pubescence. The specimens cited above differ from the species only in the presence of a pubescence which varies from minute papillae of epidermal cells to hairs many times the diameter of the epidermal cell. The

pubescence may be on all parts or only on a few. A long inflorescence may have a pilose pubescence at the base and only papillae near the apex of the rhachis. For the present it seems well to designate these variations as forms until the species can receive more adequate treatment in the field and perhaps cytological study.

26. *Coccoloba Cowellii* Britton, Bull. Torrey Bot. Club 42: 368. 1915, (as *Coccolobis*).

Shrub to 3 m. tall; branches terete, puberulent when young becoming glabrate, commonly geniculate, nodes commonly tumid, ochreae subcoriaceous, 5–7 mm. tall, dark brown, puberulent; leaf blades ovate-elliptic to ovate-lanceolate, apex acuminate to rounded, base cordate, 9×6 cm. long and wide on normal shoots, coriaceous, strongly bullate, midrib and primary veins impressed above, prominent below, primary veins 5–7 pairs, arcuate anastomosing, upper leaf surface smooth, shining, lower leaf surface sparsely puberulent becoming glabrate, secondary venation obscure; petioles 3–6 mm. long, puberulent; leaves of vigorous shoots or of adventitious shoots extremely variable in shape usually lanceolate-ovate, long attenuate at the apex, cordate at the base, to 23×2.5 cm. long and wide; inflorescence terminal 11–23 cm. long, with several concentric ochreae at the base, rhachis glabrous, red in color; staminate flowers in clusters of 2–4, pistillate flowers solitary, bracts ovate, less than 0.5 mm. long, ochreolae membranaceous, to 0.5 mm. long, flowering pedicels 5 mm. long, bright red, perianth red, hypanthium 1 mm. long, perianth lobes 2 mm. long and broad, fertile stamens with filaments to 2 mm. long, functional pistil 2.5 mm. long; fruiting pedicels 5–10 mm. long, fruit dark red, ovoid, rounded at the base, attenuate at the apex, to 6 mm. long, 4 mm. thick, perianth lobes subcoronate, 1–2 mm. long at apex of fruit.

DISTRIBUTION: Cuba.

CUBA: Oriente: Loma del Mucará, Nagua, S. of Yara, *Leon & Ekman 11031* (G). Camaguey: savannahs near Camaguey City, *Britton, Britton & Cowell 13151* (TYPE, NY; ISOTYPES, FM, MO, US); Santayana, *Leon 15787* (G, NY), *15789* (NY), *Ekman 19037* (S).

This is a striking species with its smooth shining bullate leaves and the handsome red inflorescence with flowers on long pedicels. Specimens collected in flower in April, June and July; collected in fruit in July.

The variation between the normal leaves and the leaves of vigorous and adventitious shoots is as striking in this species as any in the genus. More extensive collections of this species are desired.

27. *Coccoloba diversifolia* Jacq. Enum. Pl. 19. 1760, Hist. Stirp. Amer. 114, pl. 76. 1763.

Coccoloba cubensis Meisn., DC. Prodr. 14: 162. 1857.

Uvifera cubensis O. Ktze. Rev. Gen. 2: 561. 1891.

Coccoloba floridana Meisn., DC. Prodr. 14: 165. 1857.

Coccoloba Curtissii Lindau, Engl. Bot. Jahrb. 13: 159. 1891.

Uvifera Curtissii O. Ktze. Rev. Gen. 2: 561. 1891.

Coccoloba laurifolia Lindau, Engl. Bot. Jahrb. 13: 158. 1891, and all recent authors, not Jacquin.

Coccoloba longifolia Schmidt, Fedde Rep. 24: 73. 1927, not Fischer.

Guaibara laurifolia (Jacq.) House, Am. Midl. Nat. 8: 64. 1922 (as *Guaibara*).

Shrub or tree to 7 m. tall; branches terete, often geniculate by limited growth, glabrous, nodes rarely slightly tumid; ochreae coriaceous in the lower portion, this persisting, membranaceous and deciduous above, 3–5 mm. long; leaf blades ovate, oval, oblong, elliptic, lanceolate or obovate, variable on a single shoot, apex rounded, obtuse, acute or acuminate, base cuneate to rounded or subcordate, 4×3.5 , 7×5.5 , 8×4.5 , 12×8 cm. long and wide, coriaceous, often shining above, dull beneath, glabrous, midrib and primary veins slightly prominent above, secondary venation reticulate on both surfaces, primary veins 3–7 pairs, arcuate, anastomosing before reaching the margin, margin entire, commonly slightly recurved; petioles glabrous, 7–10 mm. long; leaves of adventitious shoots similar in shape to those of normal growth but larger in size, 17×8 , 24×13 , 32×12.5 cm. long and wide, on petioles 1–2.5 cm. long; leaves of wind-swept specimens often much smaller than those of normal shoots, 2×1.3 , 3×2 cm. long and wide; inflorescence terminal, 4.5, 9, 11 to 18 cm. long, rhachis glabrous; staminate flowers in clusters of 2–5, pistillate flowers solitary; bracts ovate, less than 0.5 mm. long, 1 mm. broad, glabrous; ochreolae membranaceous, less than 0.5 mm. long, glabrous, flowering pedicels 2–4 mm. long, glabrous; hypanthium 1 mm. long, perianth lobes 2×2 to 3×1 mm. long and broad, filaments of stamens from male flowers 1 mm. long; fruiting pedicels 3–4.5 mm. long, fruit globose to obpyriform, 10×7 , 12×8 , 13×8 mm. long and thick, perianth lobes appressed at the apex of the achene.

DISTRIBUTION: Florida, Bahamas, Greater and Lesser Antilles.

CUBA: Oriente: Santiago and vicinity, *Ekman* 1399 (S), *Ekman* 7776 (S), *Ekman* 8938 (FM, S), *Ekman* 8962 (MO, S), *Havard* 20 (NY), *Leon & Clemente* 3045 (G, HAB), *Clemente* 3792 (G, HAB), 3793 (G, HAB); Bayate, Monte Oscuro, *Ekman* 6110 (NY, S), 6247 (MICH, S, US), 4628 (S); Bayate at Paso Estancia, *Ekman* 6276 (A, S); Monte de Ocujal, near Central Manate, *Leon* 15759 (G, NY, HAB), *Leon* 16796 (HAB); Punta Maisi, *Shafer* 7929 (FM, NY, US); Preston, *Ekman* 3470 (FM, S); Jiguani, *Ekman* 15028 (G, MO, S); Gibara to Punta Hicacos, *Shafer* 1473 (NY, US); Punta Piedra, Nipe Bay, *Britton*, *Britton & Cowell* 12487 (NY); Imías, *Leon* 12157 (NY), 12486 (NY); Sabanalamar, near Central Manati, *Leon* 15737 (NY); Cupey, *Ekman* 4942 (FM, S), 6300 (S); Palma Sola, *Wright* 112 (HABA); Sierra de Nipe, near Rio Piloto, *Ekman* 5795 (S); Banes, near Puerto Rico, *Ekman* 6632 (S); Locality unspecified, *Linden* 2047 (BR, K, TYPE of *C. cubensis*), *Wright* 3668 (G), *Le Roy*, without number (NY). Camaguey: La Gloria, *Shafer* 415 (FM, G, NY, US); Santa Lucas, *Shafer* 952 (FM, G, NY, US); Ganado, Cayo Sabinal, *Shafer* 898 (NY, US). Isle of Pines: Milian, N. of Caleta Grande, *Roig & Cremata* 1853 (NY); S. of Santa Fe, *Jennings* 656 (G, NY, US). Collected in flower: May, July, Nov. Collected in fruit:

Feb., Mar., Apr., June, July, Aug., Sept., Nov., Dec. Local names in Cuba: *uvilla, uvillo, uverillo, uva de paloma, fruta de paloma*.

For many years a species of *Coccoloba* with sessile flowers and fruit, that is, the pedicels shorter than the ochreolae, has been passing under the name of *C. diversifolia* Jacq. The drawing of *C. diversifolia* in the original publications by Jacquin shows a fruiting specimen with pedicels 3-4 times the length of the ochreolae. It is obvious therefore that material called by all recent authors *C. laurifolia* is really *C. diversifolia* Jacq. *Coccoloba laurifolia* Jacq. is based on a flowering specimen collected near Caracas, Venezuela. Sufficient material from S. America is not available to me at the present time to determine if this is identical with the W. Indian *C. diversifolia* here treated. It may well be, and *C. laurifolia* Jacq. may well belong in the synonymy of the present species. In any case *C. laurifolia* Jacq. is a later name than *C. diversifolia* which must be used for the specimens under consideration here. All recent authors have overlooked this misinterpretation and it is unfortunate that such a widespread species and one commonly used as a horticultural plant must have a change of name.

The type drawing of *C. diversifolia* Jacq. can be matched in any one of a dozen of the collections cited above. The leaf variation is tremendous on a single herbarium sheet and on single trees which I have observed in the field. Young vigorous shoots may have large leaves. Specimens growing along the sea coast and exposed to strong winds and salt spray are often much contorted in form and the leaves are much smaller than protected plants growing a few yards farther inland. In the Bahamas it was possible to observe the effect of cutting of these trees to clear garden patches. Recently cut trees developed large, fast-growing adventitious shoots with tremendous leaves when compared with the undisturbed trees. Many of these adventitious shoots and leaves match the specimens which Schmidt referred to *C. longifolia* Fisch. ex Lindau (*Ekman* 1399, 4628).

As in many other species of *Coccoloba* in the Caribbean the fruits of *C. diversifolia* will commonly change shape in the process of maturing. For that reason it is difficult to use the shape of the fruit as diagnostic of a species. Fully mature fruits must be used in comparison of size and shape in this species.

Coccoloba cubensis of Meisner was based on a collection made by Linden. I have seen two specimens of this collection from the Brussels and Kew Herbaria. Both are similar and the leaves are small in comparison with the bulk of the material cited above. If this species were considered from the standpoint of the Cuban material alone, then *C. cubensis* would be comparable to the recent material from the Isle of Pines and might be worthy of varietal status; however, when material from the Bahamas, Florida, Jamaica, Puerto Rico and Hispaniola is considered, then the Linden specimens become one end of a long line of variations.

Lindau described the species *Coccoloba Curtissii* based on two collections of Curtiss from Florida, one from the Florida Keys and the other

from Merritts Island. Lindau distinguished this species on the presence of small protuberances (teeth) between the stamens in the flowers. Unfortunately Lindau did not recognize the unisexual condition of the flowers in *Coccoloba*. The specimens of Curtiss cited by Lindau are staminate and the protuberances which he mentioned can be found in many flowers of the specimens cited above.

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THE GENUS *CARYA* IN MEXICO

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FIVE SPECIES OF *Carya* have been reported from Mexico, *C. illinoensis* (Wang.) K. Koch, *C. myristicaeformis* (Michx. f.) Nutt., *C. mexicana* Engelm., *C. tetraptera* Liebm., and *C. Diguetii* Dode. The distribution of the first three is given in Standley, Trees and Shrubs of Mexico (Contrib. U. S. Nat. Herb. 23: 165-167. 1920), Martinez, Las Plantas mas utiles que existen en la republica mexicana (pp. 295-297. 1928), and Martinez, Catalogo de nombres vulgares y cientificos de plantas mexicanas (pp. 330-333. 1937). In the last article the distribution is given under the alphabetically arranged common names such as *nogal*, *nogalillo*, *nuez*.

Various collectors during the past twenty years have added information concerning the distribution of the species. Studies by the writer on the types of the last two species mentioned above indicate these to be synonyms of the first species. One species has been reduced to varietal rank and one new species related to *C. cordiformis* has been proposed.

The writer wishes to thank the curators of the various herbaria for their generosity in lending specimens; especially Dr. O. Hagerup, Botanisk Museum, Copenhagen, Dr. H. Humbert, Museum d'Histoire Naturelle, Botanique, Paris, and Dr. R. Llamas, Instituto de Biologia, Chapultepec, Mexico.

Following is a key to the Mexican species of *Carya*:

1. Leaflets 5, each serration with a dense tuft of hairs on one or both sides of its apex; bud-scales brown, imbricated; fruit not winged at the sutures, the husk rather thick.....4. *C. ovata* var. *mexicana*.
1. Leaflets 7-15, the serrations glabrous or ciliate but without special dense subapical tufts of hairs; bud-scales valvate; fruit winged at the sutures at least above, the husk thin..... 2
 2. Buds bright yellow; leaflets strongly to densely glandular-lepidote beneath, the glands yellow; all leaflets sessile; nut slightly flattened, not mottled, 4-celled in lower half, thin-shelled; seed probably bitter, the endosperm ruminating.....3. *C. Palmeri*.
 2. Buds grayish-hairy (over yellow) or brownish; leaflets either remotely lepidote or densely grayish- or brownish-lepidote beneath; leaflets sessile or stalked; nut terete, mottled, 2-celled, or if 4-celled only at extreme base; seed sweet, the endosperm not ruminating.. 3
 3. Buds and often twigs very densely grayish- or brownish-lepidote, essentially glabrous; leaflets not falcate, usually sessile, very densely grayish- or brownish-lepidote beneath, usually appearing lustrous or silvery white; bud-scale scars crowded, forming a narrow ring; nut very thick-shelled, without lacunae in the septa; common peduncles of the staminate catkin clusters well developed, at the base of the terminal leafy growth only....
.....2. *C. myristicaeformis*.

3. Terminal buds hairy, the lateral brown with scattered yellowish glands, glabrous or hairy; leaflets remotely yellow-lepidote beneath, not lustrous, often strongly falcate, the terminal and often the lateral stalked; bud-scale scars high, the pairs separate, not forming a ring; nut mostly thin-shelled, with lacunae in the primary septa and in the secondary internal ribs; peduncles of the staminate catkin clusters very short, at base of terminal leafy shoots and also on special leafless shoots from old wood.
.....1. *C. illinoensis*.

A list of collections is recorded for each species in order to validate the distribution. Also recorded are the herbaria wherein the specimen may be found. When the material is sterile no symbol is given. Whenever staminate flowers, pistillate flowers, immature fruit, or mature fruit as well as leaves are present, indication is made by the abbreviations *stam.*, *pist.*, *im. fr.*, or *fr.* respectively; *fr. only* indicates that no leaves are present. The following are the herbaria and their abbreviations as used in this paper: AA = Arnold Arboretum; CM = Chicago Natural History Museum; BPI = Bureau of Plant Industry, U. S. D. A.; GH = Gray Herbarium; MO = Missouri Botanical Garden; Mich = University of Michigan; NY = New York Botanical Garden; Tenn = University of Tennessee; Tex = University of Texas; US = U. S. National Herbarium; USFS = U. S. Forest Service; WEM = the writer's personal herbarium; Cop = Botanisk Museum, Copenhagen, Denmark; Mex = Instituto de Biología, Chapultepec, Mexico; Paris = Museum d'Histoire Naturelle, Botanique, Paris, France.

1. *Carya illinoensis* (Wang.) K. Koch, Dendr. 1: 593. 1869.

Carya pccan (Marsh.) Engl. & Graebn., Notizbl. Bot. Gard. Mus. Berlin, App. 9: 19. 1902.

Carya tetraptera Liebmann, Vidensk. Meddel. Naturh. For. Kjøbenh. 1850: 80. 1850.

Carya Diguetii Dode, Bull. Soc. Bot. France 55: 470. 1908.*

Large tree; leaflets 9–17, the lateral ones sessile or short-stalked, acute at the base, typically narrow, oblong-lanceolate, falcate, but sometimes broader, ovate, not falcate; terminal leaflet stalked; twigs, rachises, and lower leaflet surfaces glabrate to densely puberulent; bud-scales valvate; terminal bud grayish yellow-hairy, the lateral buds brown, glabrate or occasionally pubescent, with few to many yellow glands, the bud-scales frequently broken off and exposing the densely silky-pubescent inner leaves; bud-scale scars broad, the pairs separated, not forming a ring; clusters of staminate catkins subsessile or short-stalked (stalk usually 1–3 mm. long), located at the base of an elongate leafy new growth and also in pairs at the base of special short leafless branches from old wood; fruit brown, elliptical to oval, mostly 4-winged and -angled to the base; nut elliptical to oval, cylindrical, not angled or very slightly so above,

* See Little, Amer. Midl. Nat. 29: 501. 1943 for other synonyms and discussion of name.

brown, mottled with irregular darker brown markings; husk and nut-shell thin; true secondary (dorsal) septa essentially absent, the short projections from the primary wall not usually reaching the outer wall of the nut, the nut 2-celled in the lower half or somewhat 4-celled at the extreme base; primary septa and internal secondary ribs (ridges) with lacunae, the lacunae of the latter not clearly covered with a hard wall.

VERNACULAR NAMES: *La nuez chiquita*; *nogal liso*; *liso o encarcelado*; *nogal morado*; *nuez encarcelado*; *nogal de Cuilpan*; *nogalito*; *pecan*.

NUEVO LEON: Monterrey, *C. K. Dodge* 19 stam. (GH, US); *C. H. & M. T. Muller* 65 fr. (AA, CM, Tex, Mex); *C. R. Orcutt* 1076 fr. (US); *C. S. Sargent* in 1900 (*Canby* 222) stam. (AA, US).—Monterrey, Sierra de la Silla, alt. 1700 ft., *C. G. Pringle* 11177 fr. (CM, GH, MO, NY, US, Mex).—Monterrey, Remate, *G. Arsène* 6164 (*Abbqn* 179) fr. (AA, GH, MO, US).—Galeana, along bank of stream, alt. 5400 ft., *V. H. Chase* 7737 im. fr. (BPI, CM, GH, MO, NY). TAMAULIPAS: San Jose, Sierra de San Carlos, *H. H. Bartlett* 10394 fr. (US).—La Morita, Marmolejo, *H. H. Bartlett* 10738 fr. (US).—South Victoria, La Jolla Ranch, *R. Runyan* 1011 stam., pist. (AA, Tex, US); *R. Runyan & B. C. Tharp* 4070 stam., pist. (Tex).—Jaumave, *H. W. Viereck* 302 (US); *L. H. Dewey* 3/31/1903 (MO).—Cerca les minas de Victoria a Tula, *J. L. Berlandier* 855–2275 (GH). SAN LUIS POTOSI: Tamazunchale, *M. T. Edwards* 937* (CM, MO, Tex).—Alvarez, *C. C. Parry & E. Palmer* 835 $\frac{1}{2}$ *pro parte*, fr. (GH, MO, US). JALISCO: Zapotlan, *B. P. Reko* 4672 stam. (US). HIDALGO: Ixmiquilpan, *J. N. Rose, J. H. Painter & J. S. Rose* 8945 fr. (CM, NY, US).—Tecoquantla, *F. Salazar* in 1913, fr. (US, Mex). GUANAJUATA: Moist soil in stream-bottom canyon, 5 km. west of Xichu, alt. 1600 m., *E. L. Little Jr.* 11074 fr. (USFS, WEM).—Pamillas, Rio Pamillas, 25 km. northeast of San Luis de la Paz, moist soil in canyon bottom, alt. 1740 m., *E. L. Little Jr.* 11090 fr. broadly winged (USFS, WEM); same general locality, *E. L. Little Jr.* 11091 fr. essentially wingless (USFS, WEM), and *E. L. Little Jr.* 11092 fr. narrowly winged (USFS, WEM). COAHUILA: Muzquiz, *E. Marsh* 6 pist. (Tex).—Monclova, alt. 2000 ft., *S. S. White* 1702 (Mich). OAXACA: Oaxaca, at foot of Cerro de San Felipe, open pasture-like area, *A. J. Sharp* 45915 (Tenn, WEM).—Oaxaca, Monte Alban, *J. N. Rose & W. Hough* 4657 fr. (US).—Cuilapa, *F. Liebmann* 3777 im. fr., old pist. (Cop, CM).—MORELOS?: (marked "Morelia: Parco"): *Arsène* I/1910 (CM). MEXICO: "Mexique, region de Mexico," *M. L. Diguët* in 1908, fr. (Cop, Paris).

This species was reported by both Standley (1920) and Martinez (1928, 1937) as growing in Nuevo Leon, San Luis Potosi, and Hidalgo. Both authors indicate also possible distribution in Oaxaca, apparently referring to the uncertainty of the identification of the collections of Liebmann. In addition to the above states, the species is now definitely known from Tamaulipas, Jalisco, Guanajuata, Coahuila, Oaxaca, and possibly from Morelos and Mexico D. F. I. M. Johnston (Jour. Arnold Arb. 25: 435. 1944) writes as follows about its presence in Coahuila: "Reported as growing wild in northeastern Coahuila along the bottomlands of the Rio San Diego, Rio Rodrigo, and Rio Sabinas, by Pablo

* Specimen incomplete, hence identification uncertain; it might be *Carya Palmeri*.

Frick, Mexico Forestal 1: 11-14, fig. (1923), and by Angel Roldan, Mexico Forestal 3: 30-32, fig. (1923). I have been told of pecan-trees which formerly grew about Muzquiz and Nacimiento. I have seen no specimens from Coahuila. However, the species is to be expected in northeastern Coahuila, for pecans have been collected in Val Verde (Devils River) and Uvalde Counties in adjoining Texas." The pecan also grows wild in southeastern United States.

The natural distribution in Mexico is somewhat uncertain, as the trees have definitely been introduced in some areas (see Martinez 1928), and few herbarium labels have clear notes on habitats. On *Liebmann 3777* it is recorded that the trees grow wild on hillsides, and on *Runyan 1011* it is indicated that the trees are abundant on the sides of mountains in Tamaulipas. On the other hand, the field notes on Dewey's specimen indicate that the many large trees at Jaumave, Tamaulipas, have been introduced from Texas. It is evident that much of the range indicated above is a natural one, with part of the range represented by cultivated trees only, and in other areas by a mixture of native and cultivated trees.

The writer has seen the types of both *Carya tetraptera* Liebm. and *C. Diguetii* Dode. The type of the former, *Liebmann 3777* (with four sheets collected at different times) consists of essentially glabrous specimens of typical pecan with 9-11 (7-13?) narrow stalked leaflets. The immature, strongly 4-winged fruits and the nearly mature fruit indicate that the fruit and nut are elongate, essentially elliptical or oval. The sterile isotype at the Chicago Museum of Natural History has hairy, broader, less falcate leaflets characteristic of certain trees of *C. illinoensis*. Dode (1908) described *C. Diguetii* as belonging to the section EUCARYA and related to *C. texana* DC., having 6-10 sessile leaflets, and the staminate catkins on new wood. (Little, Amer. Midl. Nat. 29: 502. 1943, has pointed out that the name *C. texana* has been used for two or possibly three different species, in two different sections; the photograph of the type of *C. texana* DC. from Geneva seen by the writer merely shows that the 9-13 leaflets are very hairy and does not indicate the section to which it belongs, but the number of leaflets suggests APOCARYA.) However, the type specimen, collected by Diguet in 1908 (poorly pressed by the collector), belongs to the section APOCARYA. Some of the staminate catkins are clearly on special short branches from the old wood, the bud-scales are valvate, and there are lacunae in the primary septa and in the secondary internal ribs of the nut. The nut, although small (19-21 mm. long and 13-15 mm. in diameter) and somewhat oval-cylindrical, is a typical pecan both externally and internally. The nuts from Copenhagen examined by the writer were so darkened by oil and age that darker markings could not be observed. *Pringle 10167* (cited by Dode as *C. Pringle*, Sierra Madre above Monterrey, Mexico, 2500-3000 ft., 1906, distributed without fruit as *C. myristicaeformis* Nutt.), stated by Dode as undoubtedly belonging to this species, and upon which much of his description of the leaves seems to have been based, actually belongs to *C.*

Palmeri described below. The disposition of *C. Diguetii* must, however, be based on the type specimen. (It should be pointed out that the specimen of *Pringle* 1963 referred by Sargent in Sylva 7: 146. 1895, to *C. myristicaeformis*, is true *C. myristicaeformis*. Dode erroneously cited — by references — *Pringle* 10167 and *Pringle* 1963 as the same.)

2. *Carya myristicaeformis* (Michx. f.) Nutt. ex Ell. Sketch Bot. S. Car. & Ga. 2: 628. 1824.

Carya myristicaeformis Nutt. Gen. No. Amer. Pl. 2: 222. 1818; *nomen nudum* (see discussion of name in Little, 1943).

Small or large tree; leaflets 7–9, rarely 11, all typically sessile or subsessile, usually not falcate; younger parts of twigs, rachises, and lower leaflet-surfaces densely brown- or gray-glandular-scaly (lepidote), the scales often touching each other, the lower surface of the leaflets usually lustrous brown or silvery white, typically glabrate; bud-scales valvate, brownish; terminal buds about 7 mm. long, broadly ovate, not flattened; bud-scale scars narrow, crowded, forming a ciliate ring, though this is not always distinct; staminate catkins with a definite common peduncle located only at the base of strong new leafy growth; fruit densely brown-scaly, 4-wing-valved to base, the husk thin; nut oval, cylindrical, medium brown, mottled, not angled, with very thick shell, the secondary septa so low that they appear absent, so nut 2-celled except at the extreme base where it is 4-celled; lacunae in the nut-shell essentially absent.

VERNACULAR NAME: *Nutmeg hickory* (in the U. S. A.).

NUEVO LEON: Monterrey: *C. H. & M. T. Muller* 64 fr. (AA, CM, Mex); *C. H. Muller* 2655 fr. (BPI, GH); *C. G. Pringle* 1963 fr. (AA, CM, GH, MO, NY, US).—Santiago, Horsetail Falls, *V. H. Chase* 7802 fr. (BPI, CM, GH, MO, NY).—15 mi. SW. of Galeana, *C. H. & M. T. Muller* 1142 fr. (AA, CM, Mich, NY, US, Mex).—El Cercado, 30 mi. S. of Monterrey, *C. H. & M. T. Muller* 1352 fr. (AA, CM, Mich, Mex).—Hacienda Vista Hermosa, 35 mi. S. of Monterrey, alt. 2350 ft., *S. S. White* 1629 fr. (GH, Mich).

Martinez (1928) does not seem to report it, but Standley (1920) and Martinez (1937) report it from Nuevo Leon. It has so far been reported from no other state. This species also occurs in southeastern United States.

The field notes for *Muller* 2655 state: "Large shrub up to 15 ft. or small tree to 25 ft. Mature trunks with bark scaling like shagbark. A common constituent of the oak-hickory wood. Canon Diente."

3. *Carya Palmeri* * sp. nov.

Shrub or medium-sized tree up to 1 × 40 feet; larger leaves 23–37 cm. long, 15–28 cm. wide; leaflets 9–11, rarely 13, lanceolate to oblong- or ovate-lanceolate to rarely obovate, sessile, the lateral with rather broad

* Foliolis 9–11, rariter 13, sessilibus, subtus dense aureo-glanduloso-lepidotis; gemmis aureis, perulis valvatis; fructibus 4-alatis, exocarpio tenue; nuce non variegata, subcompressa, putamine dissepimentisque tenuissimis, ad medium 4-loculato.

obtuse or even subcordate bases, occasionally falcate, finely serrate, strongly yellow-glandular-scaly beneath, the glands thick, leaflets greenish or more commonly appearing strongly yellowish brown beneath but not truly lustrous-sericeous as in *C. myristicaeformis*; uppermost lateral leaflets 9–20 cm. long, 2–6 cm. wide, the terminal leaflet only slightly larger; twigs, rachises, and lower leaflet-surfaces glabrate or commonly strongly pubescent; terminal bud 8–11 mm. long, slender, strongly flattened, all buds bright yellow because of dense yellow glands, glabrate to slightly puberulent at apex, frequently short-stalked, the bud-scales valvate, apparently only one or two pairs; bud-scale scars rather broad, the pairs separated, not forming a ring; staminate catkins about 8 cm. long on new growth at base of elongate leafy shoots or on special short leafless shoots from old wood, the common peduncle of the cluster short, 4–8 or even to 12 mm. long; bract of the flower slender, longer than the bracteoles; fruit frequently with a short stipe, 3–4 cm. long, 2–3 cm. thick, strongly 4-ridged to the very base, usually winged along the sutures to the base, strongly yellow-scaly, the husk very thin, 0.5–1 mm. thick, final dehiscence uncertain; nut gray-brown, not mottled, not angled, only slightly flattened, about 2.4 cm. thick parallel to the primary partition, the shell very thin (about 1 mm. thick), cavity for embryo very large, the secondary septa strongly developed to about the middle of the nut, so nut 4-celled to about the middle, primary septa and secondary internal ribs with strong brown-filled lacunae; endosperm ruminating, hence seed probably bitter. This species belongs to section APOCARYA.

NUEVO LEON: Monterrey, Sierra Madre, alt. 2600 ft., *C. G. Pringle* 13957 fr. (GH, Mich, US). — Monterrey, Cañon Diente, *C. H. Muller* 2643 fr. (BPI, GH). — Monterrey, Sierra Madre, alt. 2500–3000 ft., *C. G. Pringle* 10167 stam. (GH, MO, NY, US, Mex, Paris). — Monterrey, Sierra Madre, *C. G. Pringle* 13200 fr. (TYPE GH; CM, US, Mex), Sept. 7, 1904. — Municipio de Villa Santiago, Cañon Guajuco, Rancho Vista Hermosa, abundant in upper oak-hickory forest, *C. H. Muller* 2034 im. fr. (AA, CM, Mich, Mex). — Villa de Santiago, Horsetail Falls, alt. 2500 ft., *Mr. & Mrs. W. C. Leavenworth* 811 (CM, MO).

The species is named after Mr. Ernest J. Palmer, one of the foremost students of *Carya*, a friend of the writer, and for many years collector and research assistant at the Arnold Arboretum, Harvard University.

Most of the specimens were originally called *C. myristicaeformis*, because of the strong yellow color of the lower surface of the leaflets. *Carya Palmeri* differs from *C. myristicaeformis* in its bright yellow buds, the yellow-brown color of the lower leaflet-surfaces, and especially in the external and internal structure of the nut. It differs in these same respects from *C. illinoensis*, and in addition in the sessile leaflets. The species is very closely allied to *C. cordiformis* in that the buds, sessile leaflets, and internal structure of the nut are essentially identical. *Carya Palmeri* differs in having: (1) the fruit 4-winged-valved to the base instead of to the middle; (2) 9–13 instead of 7–9 (rarely to 11) leaflets; (3) more frequently hairy rachises and twigs; (4) strongly yellow fruit and lower

leaflet surface; (5) the leaflets more frequently falcate; (6) a stipe to the fruit; and (7) a longer staminate floral bract.

There are two different groups of specimens representing the species, one with strikingly yellow or yellowish brown lower surfaces of the leaflets (*Pringle 13957*, *Pringle 13200*, *Muller 2034*) and one with leaflets somewhat greener beneath (*Muller 2643*, *Leavenworth 811*, *Pringle 10167*). This second group is closer to *C. cordiformis* in its leaves, and it suggests the possibility that *C. Palmeri* might be a hybrid between *C. cordiformis* and either *C. illinoensis* or *C. myristicaeformis*. Certain features, however, are not intermediate. In each group mentioned above the leaflets and rachises may be glabrate or strongly pubescent, and the leaflets may be narrow and small, or broader and larger. In *Pringle 13200* and *Muller 2034* the uppermost lateral leaflets are 9–11 cm. long and 2–3.5 cm. wide, the leaves up to 23 cm. long and 15–20 cm. wide; in *Leavenworth 811* the leaflets are 15–20 cm. long and 5–6 cm. (terminal 6.5 cm.) wide, the leaves 28–37 cm. long and 22–28 cm. wide.

4. *Carya ovata* (Mill.) K. Koch var. *mexicana* (Engelm.) comb. nov.

Carya mexicana Engelm. ex W. B. Hemsley, Biol. Cent. Amer. Bot. 3: 162. 1883.

Tree, 15 to 20 meters high; leaflets 5, mostly obovate, sometimes oblanceolate, at least the terminal one strongly stalked, each serration with one or two dense subapical tufts of hairs, the serrations slender appressed to short, divergent and stout; rachis, twigs, and lower surface of leaflets glabrate to pubescent; buds brown, the terminal ones 9–15 mm. long, the scales overlapping, the outer persistent in winter; bud-scale scars crowded into a narrow usually hairy ring; staminate catkins at the base of long leafy shoots, the common peduncle elongate; fruit subglobose to oval, with a comparatively thin husk (3–6.5 mm. or even 1.5–3 mm. thick), 4-valved to the base, brown, not notably glandular nor winged; nut flattened, slightly to strongly 4-angled, whitish to whitish brown; secondary partition high, sometimes thick, the ends of the primary septa frequently much thickened, without lacunae.

VERNACULAR NAMES: *Nogalillo de San Luis Potosi*; *nogal motudo*; *nogal Rayado*.

NUEVO LEON: Sierra Madre Oriental: Puerto Blanco to Tarey, 15 miles SW. of Galeana, *C. H. & M. T. Muller 1226* fr. (AA, CM, Mich, NY, Tex, US, Mex).—El Cercado, 30 miles S. of Monterrey, *Muller 1355* (AA, CM, Mich, Tex). SAN LUIS POTOSI: Alvarez, *C. C. Parry & E. Palmer 835 ½ pro parte* (see under *C. illinoensis* for other 835 ½), type of *C. mexicana* at Kew not seen by the writer, but the following three isotypes seen: lf., fr. MO, lf. only GH, fr. only AA.—*Parry & Palmer 834 ½* (GH).—*E. Palmer 71* fr. (AA, BPI, GH, CM, MO, NY, US, Mex).—*Goodman 1910, 1916*, fr. only (AA). TAMAULIPAS: San Jose, *H. H. Bartlett 10253* (CM, GH, US).—Cerro Barril, *Bartlett 10488* (US); *Bartlett 10490* fr. (US).—Cerro Zamora, El Milagro, *Bartlett 11080* fr. (CM, GH, US).—La Jolla Ranch, So. Victoria, *R. Runyan 1019* stam. (AA, US). QUERETARO: Pinal de Amoles (Armales?), *E. W. Nelson & E. A. Goldman 3934* (GH,

US). HIDALGO: near Chapatla, below Alumbres, not far from Zacualtipan, alt. 6500 ft., *A. J. Sharp* 46207 (Tenn, WEM). PUEBLO: slopes above Rio Necaco, toward Huauchinango, alt. 4700 ft., *A. J. Sharp* 45377 (Tenn, WEM). — "Parco," *Nicolas* in 1909 (CM).

Both Martinez (1937) and Standley (1920) report the *Mexican shag-bark* from San Luis Potosi and Queretaro. In addition to these states, collections have been made from Nuevo Leon, Tamaulipas, Pueblo, and Hidalgo. *Carya ovata*, called *shag-bark* or *shell-bark hickory* occurs in the eastern United States, extending from southern Maine to as far south as Texas.

This species was separated from *C. ovata* by Engelmann by its smaller buds, its more pubescent leaves, and its closer, more appressed serratures on the leaflets. The buds on the type, it is true, are somewhat shorter than those found in characteristic *C. ovata*, but they may represent axillary buds on fruiting twigs or terminal buds at the tips of short twigs. As pointed out by Rehder (1935), the buds on some specimens are 15 mm. long. The serrations are appressed on the type, but on many other specimens the serrations are short, divergent and broad as characteristic in *C. ovata*; furthermore some specimens of *C. ovata* from the northwestern portion of its range in the United States have slender appressed serrations.

Rehder (1935) pointed out that he saw no character distinguishing *C. mexicana* from *C. ovata*. According to the view of the writer the Mexican trees are difficult to separate even as a variety, but on certain trees the nut shell or the partitions are quite thick, the nut shell is often only slightly angled, and the husk may be quite thin (not on the type). Consequently in the aggregate these trees, all certainly very closely related, may be considered a geographical variety. Many of these features may, however, be found separately on individual trees of characteristic *C. ovata* in the United States, as far north as Massachusetts.

Rehder's *C. mexicana* forma *polyneura* should be transferred to this new variety.

- 4a. *Carya ovata* (Mill.) K. Koch var. *mexicana* (Engelmann) Manning
forma *polyneura* (Rehder) comb. nov.

Carya mexicana Engelm. forma *polyneura* Rehder, Jour. Arnold Arb. 16:
448, 1935.

This form (*C. H. & M. T. Muller* 1226, type at AA; and *Muller* 1355) appears different at first glance, but is probably a mere ecological form, possibly a variation occurring on certain parts of a tree. In the leaflets the veins are closer and more conspicuous. More field study is necessary. It is interesting that in its glabrous twigs and leaflets and dark buds this form approaches *C. carolinae-septentrionalis* (Ashe) Engl. & Graebn., the weak North Carolina segregate of *C. ovata*.

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FURTHER NOTES ON THE FERNS OF FIJI

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THE IMPETUS for the preparation of these notes comes from a study of a collection of 377 numbers of ferns collected in Fiji by Dr. A. C. Smith in 1947.¹ My earlier publication on Fijian Ferns² contains numerous binomials which, in my present opinion,³ are outmoded; the sequence followed in my Bulletin of 1929 is also outmoded, but for convenience of reference it is followed in the present report. In this treatment I insert brief notes on most of the species which have been reported from Fiji since my earlier report, and I also indicate the correct binomial for each species there discussed, in cases where such a change is needed. Five new species are here described, and several combinations are proposed as new. The first set of Dr. Smith's ferns is deposited in the Gray Herbarium and an essentially complete set, including types of the novelties here described, is in the herbarium of the University of California.

Botrychium daucifolium Wall. is reported as occurring in Fiji by Christensen in Bishop Mus. Bull. 177: 7. 1943. I have seen no specimens in support of this record, but such an occurrence is to be expected.

Angiopteris opaca Copel., previously thought to be a Fijian endemic, is now reported from Samoa by Christensen in Bishop Mus. Bull. 177: 8. 1943.

TRICHOMANES OMPHALODES (Vieill.) C. Chr. = *Microgonium omphalodes* Vieill.

TRICHOMANES VITIENSE Baker = *Microtrichomanes vitiense* (Baker) Copel., ranging from Queensland to Samoa.

TRICHOMANES BIMARGINATUM v. d. B. = *Microgonium bimarginatum* v. d. B.

TRICHOMANES SAXIFRAGOIDES Presl = *Gonocormus minutus* (Blume) v. d. B.

TRICHOMANES ERECTUM Brack. and T. ALTERNANS Carr. = *Crepidophyllum Endlicherianum* (Presl) Reed in Am. Fern Jour. 38: 89. 1948.

TRICHOMANES HUMILE Forst. = *Crepidophyllum humile* (Forst.) Reed, loc. cit.

¹ Dr. Smith's collections were made under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

² Bishop Mus. Bull. 59: 1-105. 1929.

³ Copeland, E. B. *Genera Filicum*. 1947.

TRICHOMANES BIPUNCTATUM Poiret = *Crepidomanes bipunctatum* (Poiret) Copel.

TRICHOMANES MEIFOLIUM Bory = *Macroglena meifolium* (Bory) Copel.

TRICHOMANES APHLEBIOIDES Christ = *Vandenboschia aphlebioides* (Christ) Copel., ranging westward to Sumatra.

TRICHOMANES MAXIMUM Blume = *Vandenboschia maxima* (Blume) Copel.

TRICHOMANES CAUDATUM Brack. = *Macroglena caudata* (Brack.) Copel., ranging from Queensland to Tahiti.

TRICHOMANES ASAE-GRAYI v. d. B. = *Macroglena Asae-Grayi* (v. d. B.) Copel., a species structurally similar to the preceding; it is *Trichomanes longisetum* Brack., and Carr., *nec* Bory; known also from Samoa and Tahiti.

TRICHOMANES CARTILAGINEUM Vieill. & Pancher, at least in part, as well as T. DENTATUM v. d. B. and T. SEEMANNII Carr. = *Selenodesmium dentatum* (v. d. B.) Copel., common in Fiji and neighboring archipelagos.

TRICHOMANES HARVEYI Carr. = *Nesopteris intermedia* (v. d. B.) Copel., ranging from New Guinea to Polynesia.

TRICHOMANES APIIFOLIUM Presl = *Callistopteris apiifolia* (Presl) Copel.

"TRICHOMANES AUSTRALICUM v. d. B." was an error in citation in Bishop Mus. Bull. 59: 27. 1929. The correct name is *Cephalomanes Boryanum* (Kunze) v. d. B.

HYMENOPHYLLUM FLABELLATUM Labill. = *Mecodium flabellatum* (Labill.) Copel.

HYMENOPHYLLUM DILATATUM (Forst.) Sw., which = *Mecodium dilatatum* (Forst.) Copel., is endemic in New Zealand. Fijian plants passing under this name and as H. FORMOSUM Brack. = *Mecodium imbricatum* (Blume) Copel., ranging from Tahiti to Java.

Mecodium polyanthos (Sw.) Copel., a pantropic species, is represented, among other Fijian collections, by *Parks 20614* and *20769*.

HYMENOPHYLLUM AUSTRALE Willd., which = *Mecodium australe* (Willd.) Copel., is known only from New Zealand and Tasmania and perhaps Victoria. Fijian plants so identified represent *Mecodium samoense* (Baker) Copel., known also from Samoa and Queensland.

Hymenophyllum affine Brack. looks like a real *Hymenophyllum*.

HYMENOPHYLLUM MULTIFIDUM (Forst.) Sw., which = *Meringium multifidum* (Forst.) Copel., is endemic in New Zealand. Its Fijian vicar, HYMENOPHYLLUM FEEJEENSE Brack., = *Meringium feejeense* (Brack.) Copel.

HYMENOPHYLLUM DENTICULATUM Sw. = *Meringium denticulatum* (Sw.) Copel.

Meringium Macgillivrayi (Baker) Copel. in Philip. Jour. Sci. 67: 44.

1938 (*Trichomanes Macgillivrayi* Baker; *Hymenophyllum Macgillivrayi* Copel.), was overlooked in Bishop Mus. Bull. 59 (1929).

To *Schizaea*, in my treatment of 1929, should be added:

Schizaea (*Actinostachys*) *melanesica* Selling in Svensk Bot. Tidsk. 38: 208. 1944.

MOTURIKI: *Seeman* 793. VANUA LEVU: Thakaundrove: Maravu, near Salt Lake, alt. 0-450 m., *Degener & Ordonez* 14144 (in dense wet forest); Mathuata: "Mudthuata Mts." [Mathuata Range, on mainland opposite Mathuata Island], *U. S. Expl. Exped.*; summit ridge of Mt. Num-builoa, east of Lambasa, alt. 500-590 m., *Smith* 6518 (also observed in dry forest on upper northwestern slopes).

In his original discussion Selling cites only two specimens, the type from New Caledonia and *Seeman* 793 (without locality) from Fiji. The species is now known to occur from New Caledonia to Tonga, but it is rare at least in Fiji; Dr. Smith reports seeing it in only the one locality cited above, during his two collecting trips.

GLEICHENIA OCEANICA Kuhn = *Sticherus oceanicus* (Kuhn) Ching.

GLEICHENIA BRACKENRIDGEI Fournier (in Ann. Sci. Nat. Bot. V. 18: 269. 1873) = *Sticherus Brackenridgei* (Fournier) comb. nov.

GLEICHENIA LINEARIS (Burm.) Clarke = *Dicranopteris linearis* (Burm.) Underw.

GLEICHENIA CAUDATA Copel. (in Bishop Mus. Bull. 59: 9. *pl.* 2. 1929) = *Dicranopteris caudata* (Copel.) comb. nov.

GLEICHENIA JAPONICA Spreng. = *Hicriopteris glauca* (Thunb.) Copel.

CYATHEA HORNEI (Baker) Copel. (*Alsophila Hornei* Baker) = *Gymnosphaera Hornei* (Baker) Copel. Gen. Fil. 99. 1947.

ALSOPHILA DISSITIFOLIA Baker, judging by the description, must also be a species of *Gymnosphaera*.

Cyathea microlepidota sp. nov.

C. gregis *C. affinis*, stipite 60 cm. alto, deorsum atropurpureo griseo-furfuraceo paleis albidis anguste lanceolatis valde attenuatis 15 mm. longis sparso, sursum fusco glabrescente cicatricibus linearibus ornato; lamina 1.5 m. alta, ovata, rhachibus inferne stramineis subglabris; pinnis infimis 25-30 cm., medialibus 50 cm. longis, 20 cm. latis, sessilibus; pinnulis 10 cm. longis, 2 cm. latis, subacuminatis, infimis brevi-pedicellatis, profunde pinnatifidis, segmentis infimis basicopicis modo reductis et interdum liberis, segmentis sequentibus 5 mm. latis, rotundatis, fere integris, costis superne setulis inflexis atrocastaneis, inferne squamulis concoloribus minutis in setulas dissolutis obsitis, sursum glabrescentibus, costulis fere glabris, venis furcatis; soris medialibus, globosis, indusiis in segmenta magna persistentia ruptis.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100-200 m., in patches of forest in open rolling country, Nov. 25, 1947, *Smith* 6654 (TYPE in herb. Univ. Calif.) ("Mbalambala." Caudex 2-4 m. high, about 5 cm. diam.; fronds about 7-9

per plant, about 1.5 m. long, the stipe about 60 cm. long, the pinnae 7-9 pairs.)

Well characterized by the minute, dark, dissected squamulae on the nether face of the costa; and notable, in the group of indusiate species with broad segments, for the long stipe and only moderately reduced lowest pinnae.

Cyathea subsessilis Copel. in Philip. Jour. Sci. 6C: 359. 1911.

Christensen (in Bishop Mus. Bull. 177: 25. 1943) has identified *Smith* 1902, from Mt. Ndikeya, Thakaundrove, Vanua Levu, as this species, described from Samoa. The collection is indeed not typical *C. propinqua* Mett., under which name it was distributed; but neither is it typical *C. subsessilis*.

Cyathea plagiostegia Copel., previously considered endemic to Fiji, is now reported from Samoa by Christensen, who lists several collections in Bishop Mus. Bull. 177: 28. 1943.

Cyathea truncata (Brack.) Copel. is common in Samoa (cf. Christensen in Bishop Mus. Bull. 177: 30. 1943).

Cyathea subbullata Copel. in Bishop Mus. Occ. Papers 15: 79. 1939.

VITI LEVU: M b a : Immediate vicinity of Nandarivatu, alt. 800-900 m., in dense forest along stream, *Smith* 5045; hills east of Nandala Creek, about 3 miles south of Nandarivatu, alt. 850-970 m., in dense forest, *Smith* 5925; Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, alt. 870-970 m., in dense forest, *Smith* 6145.

Previously known from the type, *St. John* 18304, from mountains west of Matawailevu, now in the Province of Naitasiri [formerly Tholo East]. The species is very near to the Tahitian *C. decurrens* (Hook.) Copel. and the New Caledonian *C. alata* (Fournier) Copel.

Lastrea Archboldiae sp. nov.

L. rhizomate brevi-repente, basibusque stipitum paleis fuscis lanceolatis integris 5 mm. longis vestitis; stipitibus gracilibus, 30 cm. longis, sursum glabrescentibus; lamina 25 cm. longa, basi truncata 16 cm. lata, apice acuminata, profunde bipinnatifida, rhachi sparse setifera; pinnis fere omnibus breviter pedicellatis, infimis basi angustatis, acuminatis, costis superne velutinis, inferne setis albis sparsis vestitis; segmentis erecto-patentibus, maximis 1 cm. longis 3-4 mm. latis, rotundatis, integris, sparse ciliolatis, herbaceis, viridibus, superne et ad venas et ad laminam sparse setosis; venis ca. 7-paribus, fere omnibus simplicibus, infimis supra sinus excurrentibus; soris medialibus, indusiis parvis setulosis.

VITI LEVU: M b a : Vicinity of Nandarivatu, alt. 750-900 m., Feb.-March, 1941, *Degener* 14273 (TYPE in herb. Univ. Calif.) (in open forest).

Apparently near to *Dryopteris savaiensis* (Baker) C. Chr., as described by Christensen in Bishop Mus. Bull. 177: 82. 1943, but with distinctly stalked pinnae, and without evident aerophores.

DRYOPTERIS PRENTICEI (Carr.) Kuntze = *Lastrea Prenticei* Carr.

DRYOPTERIS BRACKENRIDGEI (Mett.) Kuntze = *Lastrea Brackenridgei* (Mett.) Carr.

DRYOPTERIS HARVEYI (Mett.) Kuntze = *Lastrea Harveyi* (Mett.) Carr.

DRYOPTERIS VISCOSA (J. Sm.) Kuntze = *Lastrea viscosa* J. Sm.

Christensen (in Bishop Mus. Bull. 177: 82. 1943) cites *Smith 1669* from Fiji as *Dryopteris pubirachis* (Baker) C. Chr. This is probably correct, but I am still unable to distinguish it satisfactorily from *Lastrea viscosa*. Two supposed species of New Guinea, *Dryopteris subnigra* Brause and *D. oligolepia* v. A. v. R., represent the same species or group.

DRYOPTERIS GORDONI (Baker) C. Chr. = *Ctenitis Gordoni* (Baker) Copel. Gen. Fil. 123. 1947.

DRYOPTERIS SETIGERA (Blume) Kuntze probably = *Lastrea Torresiana* (Gaud.) Moore.

DRYOPTERIS LEUCOLEPIS (Presl) Maxon = *Lastrea leucolepis* Presl.

DRYOPTERIS SQUAMIGERA (Hook. & Arn.) Kuntze = *Ctenitis squamigera* (Hook. & Arn.) Copel. Gen. Fil. 125. 1947.

DRYOPTERIS TENUIFRONS C. Chr. = *Ctenitis tenuifrons* (C. Chr.) Copel. Gen. Fil. 125. 1947.

DRYOPTERIS FIJIENSIS (Hook.) C. Chr. = *Ctenitis fijiensis* (Hook.) Copel. Gen. Fil. 124. 1947.

Ctenitis davallioides (Brack.) comb. nov.

Lastrea davallioides Brack. U. S. Expl. Exped. 16: 202. 1854.

Dryopteris davallioides Kuntze, Rev. Gen. 812. 1891; Copel. in Bishop Mus. Bull. 59: 44. 1929, 93: 34, pl. 6. 1932; C. Chr. in Bishop Mus. Bull. 177: 97. 1943.

Dryopteris microtricha Copel. in Bishop Mus. Bull. 59: 10, 44. 1929.

Ctenitis microtricha Copel. Gen. Fil. 124. 1947.

Without yet feeling certain, I agree with Christensen (loc. cit.) that my *Dryopteris microtricha* is probably a synonym of *Lastrea davallioides*. I am also uncertain as to the proper genus for this plant. By its pubescence it seems to be a *Ctenitis*, but the anadromic dissection of the frond indicates *Rumohra*. The best developed known specimen is probably *Smith 5188*, from the summit of Mt. Tomanivi [Mt. Victoria], Mba, Viti Levu, alt. 1290–1323 m., an epiphyte in mossy forest. This specimen has fronds more than a meter long, including the stipe, and hexapinnatifid in the lower part.

DRYOPTERIS GONGYLODES (Schkuhr) Kuntze = *Cyclosorus gongyloides* (Schkuhr) Link, the type of its genus.

DRYOPTERIS HAENKEANA (Presl) Kuntze, at least as to its Guam type, is not distinguishable from *Cyclosorus unitus* (L.) Ching; see Wagner & Grether in Bishop Mus. Occ. Papers 19: 52. 1948.

DRYOPTERIS INVISA (Forst.) Kuntze = *Cyclosorus invisus* (Forst.) Copel. Gen. Fil. 142. 1947.

DRYOPTERIS ARIDA (Don) Kuntze = *Cyclosorus aridus* (Don) Ching.

DRYOPTERIS ARBUSCULA (Willd.) Kuntze = *Cyclosorus arbuscula* (Willd.) Ching; but the presence of this species in Fiji is doubtful.

DRYOPTERIS NYMPHALIS (Forst.) Copel. = *Cyclosorus*; but its distinctness from *C. parasiticus* (L.) Farwell and *C. dentatus* (Forst.) Ching is uncertain.

Cyclosorus Degeneri sp. nov.

C. stipitibus fasciculatis, ad vestigia infima pinnarum 2–8 cm., ad pinnae normales 15 cm. longis, basi paleis paucis parvis lanceolatis atrofusci praeditis, ubique pubescentibus; vestigiis pinnarum 5–15-paribus, approximatis, triangularibus, 2–4 mm. longis et latis; lamina usque ad 45 cm. longa et 10 cm. lata, acuminata, basi gradatim angustata, pinnata, rhachi ubique minute setulosa; pinnis approximatis, sessilibus, medialibus 5 cm. longis 9 mm. latis, subacutis, basi truncatis, vix medio ad costam lobatis, costis venisque setulosis, facie laminare minutissime setulosa, subcoriaceis, lobis 2–3 mm. latis obtusis; venis 4–5-paribus, 2-paribus anastomosantibus; soris medialibus, indusiis persistentibus, setosis.

VANUA LEVU: Thakaundrove: Maravu, near Salt Lake, alt. 0–450 m., Jan. 1941, *Degener & Ordonez 14209* (TYPE in herb. Univ. Calif.) (in coconut grove near ocean).

Not evidently nearly related to any other known species. The numerous vestigial lower pinnae are found on several species, the most similar of which may be *Dryopteris Christophersenii* C. Chr., which is exindusiate.

DRYOPTERIS MAGNIFICA Copel. = *Cyclosorus magnificus* (Copel.) Copel. Gen. Fil. 143. 1947.

DRYOPTERIS MICROSORA Copel. = *Cyclosorus microsorus* (Copel.) Copel. Gen. Fil. 143. 1947.

DRYOPTERIS PENNIGERA (Forst.) C. Chr. = *Cyclosorus pennigerus* (Forst.) Copel., which probably does not occur in Fiji. The local plant of this alliance is *Cyclosorus costatus* (Brack.) Copel. Gen. Fil. 142. 1947.

DRYOPTERIS UROPHYLLUS (Wall.) C. Chr. = *Cyclosorus urophyllus* (Wall.) Copel. Gen. Fil. 143. 1947.

DRYOPTERIS RUBRINERVIS (Mett.) C. Chr. = *Cyclosorus rubrinervis* (Mett.) Copel. Gen. Fil. 143. 1947.

DRYOPTERIS SIMPLICIFOLIA (J. Sm.) Christ = *Cyclosorus simplicifolius* (J. Sm.) Copel. Gen. Fil. 143. 1947.

DRYOPTERIS CESATIANA C. Chr. = *Cyclosorus Beccarianus* (Cesati) Copel. Gen. Fil. 142. 1947.

In *Tectaria*, since my publication of 1929, two additional Fijian species have been described:

Tectaria Degeneri Copel. in *Sargentia* 1: 3. 1942; related to *T. Godeffroyi* (Luerss.) Copel. but with remarkably slender pinnules and segments.

Tectaria elegans Copel. loc. cit.; a relative of *T. leuzeana* (Gaud.) Copel.

POLYSTICHUM ARISTATUM (Forst.) Presl = **Rumohra aristata** (Forst.) Ching.

Polystichum aculeatum (L.) Schott is the collective designation of several Fijian species which I do not yet venture to identify more accurately.

Polystichum pilosum sp. nov.

P. P. obtuso J. Sm. et *P. mutico* Copel. simile, stipitibus caespitosis 30–40 cm. altis stramineis gracilibus, deorsum paleis stramineo-ferrugineis 1 cm. longis 2 mm. latis acuminatis inconspicue sublaceris squamulisque laceris albidis vestitis, sursum paleis piliformibus paucis adspersis; lamina 15–20 cm. longa 7–8 cm. lata, bipinnata, rhachibus pilis et paleis piliformibus basibus parvis dilatatis dilaceratis pallidis densius vestitis; pinnis inferioribus oppositis subacutis, infimis deflexis; pinnulis oblique rhomboideis, 7 mm. longis, 4 mm. latis, rotundatis sed interdum minute spinuliferis, lateribus integris vel interdum minute spinuliferis, herbaceis, pallide viridibus, utraque facie pallide pilosis; soris parvis superficialibus, indusiis peltatis, laceris, margines versus perpallidis.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuloa, east of Lambasa, alt. 350–500 m., Nov. 3, 1947, *Smith 6484* (TYPE in herb. Univ. Calif.) (on cliffs in thin forest on rocky slope).

ATHYRIUM ACCEDENS (Blume) Milde = **Callipteris prolifera** (Lam.) Bory.

ATHYRIUM JAVANICUM (Blume) Copel. = **Diplaziopsis javanica** (Blume) C. Chr.

ASPLENIUM REMOTUM Moore. As the oldest name of this extremely polymorphic species, Christensen (in Bishop Mus. Bull. 177: 66. 1943) has chosen **Asplenium marattioides** (Brack.) C. Chr. Brackenridge gave it three specific names.

ASPLENIUM ADIANTOIDES (L.) C. Chr. is now known by its most familiar name, **Asplenium falcatum** Lam.

ASPLENIUM GIBBEROSUM (Forst.) Mett. = **Loxoscaphe gibberosum** (Forst.) Moore. *Loxoscaphe foeniculaceum* (Hook.) Moore is more finely dissected.

STENOCHLAENA OLEANDRIFOLIA Brack. = **Lomariopsis oleandrifolia** (Brack.) Mett.

STENOCHLAENA BRACKENRIDGEI (Carr.) Underw. = **Lomariopsis Brackenridgei** Carr.

Orthiopteris Copel. in Bishop Mus. Bull. 59: 14, 66. 1929.

Orthiopteris was described with one important error: the apex of the stem bears small, dark paleae. The later described genus *Ithycaulon* Copel. is therefore not distinct. For discussion see Copeland, Gen. Fil. 49, 50. 1947.

SACCOLOMA MOLUCCANUM (Blume) Mett. = **Orthiopteris minor** (Hook.) Copel.

BALANTHIUM STRAMINEUM (Labill.) Diels = *Culcita straminea* (Labill.) Maxon.

I now have on hand 18 Fijian collections representing this species, with a rather firm, entire or lobed or shallowly lacerate indusium. A species distinguished by Brackenridge and Maxon, *C. blepharodes* Maxon, is characterized most definitely by "indusium ample, delicately membranous, long ciliate."

Dennstaedtia intermedia sp. nov.

Fronde teste lectore 2-3 m. alta, stipite metrale; rhachi straminea haud rubescente, inferne glabra fere inerme, superne sulcata breviter sordide furfuracea; pinnis ca. 8-paribus fere oppositis, subsessilibus, infimis maximis 70 cm. vel. ultra longis; pinnulis etiam oppositis, infimis (pinnarum majorum) plus minus reductis, sequentibus usque ad 25 cm. longis, acuminatis, herbaceis, glabris, vix bipinnatis; pinnulisⁱⁱ usque ad 4 cm. longis, acuminatis; pinnulisⁱⁱⁱ ala angusta confluentibus, oblongis, incisis, 2 mm. latis; soris parvis (ca. 0.6 mm. latis).

VITI LEVU: Mba: Valley of Nggalawana Creek, north of the sawmill at Navai, alt. 725-850 m., in dense forest, July 21, 1947, *Smith 5373* (TYPE in herb. Univ. Calif.).

This genus was overlooked in my Ferns of Fiji (Bishop Mus. Bull. 59: 1929), although *Dicksonia incurvata* (miscited by Christensen, in Bishop Mus. Bull. 177: 33. 1943, as *D. involucrata*) had been described from Fiji. This species has since been collected by Degener, no. 14701, from the vicinity of Nandarivatu, alt. 790-900 m. Christensen (Ind. Fil. Suppl. 3: 70. 1934, and Dansk Bot. Ark. 9, No. 3: 42. 1937) has reduced *D. incurvata* (Baker) C. Chr. to *D. glabrata* (Ces.) C. Chr., but it seems to me to be a related but easily distinguishable species.

Dennstaedtia intermedia is probably the plant referred to by Christensen (in Bishop Mus. Bull. 177: 34. 1943), "which Baker named *Dicksonia moluccana* var. *inermis*, but it is neither *D. moluccana* nor *D. scandens*." It is intermediate between the group of *D. glabrata* and the body of the genus, being glabrous (except in the groove of the rachis), but without the rough, maroon axes of *D. glabrata*.

SCHIZOLOMA ENSIFOLIUM (Sw.) J. Sm. is certainly no *Schizoloma*; it was better placed when first named, as *Lindsaea ensifolia* Sw.

PTERIS DECUSSATA J. Sm. = *Pteris mertensioides* Willd.

NOTHOLAENA HIRSUTA (Poiret) Desv. is a *Cheilanthes*, apparently best to be known as *Cheilanthes javensis* Moore.

ARTHROPTERIS OBLITERATA (R. Br.) J. Sm., more strictly construed, does not occur in Fiji. The common local plant is *Arthropteris repens* (Brack.) C. Chr. in Bishop Mus. Bull. 177: 48. 1943.

Arthropteris Archboldiae Copel. in Sargentia 1: 3. 1942, from Viti Levu, is an indusiate relative of *A. tenella* (Forst.) J. Sm., of New Zealand, Norfolk Island, and Australia.

- LASTREA ARTICULATA Brack. = *Arthropteris articulata* (Brack.) C. Chr.
- OLEANDRA WHITMEEI Baker = *Oleandra Sibbaldii* Grev.
- HUMATA GAIMARDIANA (Gaud.) J. Sm., as to the Fijian plant, = *Humata Banksii* Alston (in Philip. Jour. Sci. 50: 176. 1933). Typical *H. Gaimardiana*, of the East Indies, is *H. pectinata* (J. Sm.) Desv.
- POLYPODIUM ACCEDENS Blume = *Weatherbya accedens* (Blume) Copel. Gen. Fil. 191, pl. 6. 1947.
- POLYPODIUM BROWNII Wikstr. = *Dictymia Brownii* (Wikstr.) Copel.
- POLYPODIUM LINGUAIFORME Mett. = *Microsorium linguaeforme* (Mett.) Copel.
- POLYPODIUM PUNCTATUM (L.) Sw. = *Microsorium punctatum* (L.) Copel.
- POLYPODIUM PARKSII Copel. = *Microsorium Parksii* (Copel.) Copel. Gen. Fil. 196. 1947.
- POLYPODIUM NIGRESCENS Blume = *Microsorium alternifolium* (Willd.) Copel. Gen. Fil. 197. 1947.
- POLYPODIUM SCOLOPENDRIA Burm. = *Microsorium Scolopendria* (Burm.) Copel.
- POLYPODIUM VITIENSE Baker = *Microsorium sylvaticum* (Brack.) Copel. Gen. Fil. 196. 1947. Still another name for this is *Polypodium polynesianum* C. Chr. (in Bishop Mus. Bull. 177: 116. 1943).
- POLYPODIUM WILKESII C. Chr. = *Microsorium alatum* (Brack.) Copel. Gen. Fil. 196. 1947.
- CAMPIDIA PALUSTRE (Brack.) Copel. = *Bolbitis lonchophora* (Kunze) C. Chr.
- CAMPIDIA QUOYANUM (Gaud.) Copel. = *Bolbitis quoyana* (Gaud.) Ching.
- CAMPIDIA RIVULARE (Brack.) Copel. = *Bolbitis rivularis* (Brack.) Ching.
- Lomagramma cordipinna* Holttum in Gard. Bull. Straits Settlement. 9: 202. 1937.

This is a second species of *Lomagramma* occurring in Fiji, with simply pinnate fronds, the sterile pinnae with obliquely cordate pinnae or the acroscopic side truncate. The type is from Samoa, but Holttum cited *Meebold 16856* from Fiji, and a later collection is *Degener 14565*, from the vicinity of Nandarivatu, Mba, Viti Levu.

From the group of *Elaphoglossum conforme*, Krajina (in Studia Bot. Cech. 1: 63-70. 1938) has described five species from Fiji, as follows:

Elaphoglossum vanuaense Krajina, typified by *Smith 675* and also represented by *Smith 454*, both from Thakaundrove, Vanua Levu.

Elaphoglossum Dominii Krajina, typified by a Horne specimen from Ovalau; this seems to be another name for *E. obtusifolium* Brack.

Elaphoglossum ovalauense Krajina, typified by a Brackenridge specimen from Ovalau distributed as *E. obtusifolium*.

Elaphoglossum Milnei Krajina, typified by *Milne 318*, from Viti Levu without precise locality, and also represented by *Horne 808*, from the province of Namosi, Viti Levu.

Elaphoglossum Imthurnii Krajina, typified by *im Thurn 315*, from Nandrau, Province of Nandronga & Navosa [formerly Tholo North], Viti Levu, and also represented by *im Thurn 368*, from southeastern Viti Levu.

HYMENOLEPIS MUCRONATA Fée = *Belvisia mucronata* (Fée) Copel. Gen. Fil. 192. 1947. *Smith 6093*, from northern portion of Rairaimatuku Plateau, Naitasiri, Viti Levu, is aberrant, or it may represent a new species.

POLYPODIUM CONFORME Brack., *P. LIGULATUM* Baker, *P. HIRTELLOIDES* Copel., and *P. HOOKERI* Brack. are all species of *Grammitis*.

POLYPODIUM PURPURASCENS Nad. (Enum. Pl. Indig. Tahiti 26. 1873) = *Ctenopteris purpurascens* (Nad.) comb. nov.

POLYPODIUM BLECHNOIDES (Grev.) Hook., as to all the Fijian specimens at hand, = *Ctenopteris Seemannii* (J. Sm.) comb. nov. (*Cryptosorus Seemannii* J. Sm. in *Bonplandia* 9: 262. 1861).

PROSAPTIA CONTIGUA Presl, as to the Fijian specimens only, = *Prosaptia pubipes* Copel., an endemic species.

MONOCRAMMA PARADOXA (Fée) Bedd., as to the Fijian specimens, = *Vaginularia angustissima* (Brack.) Mett.

Antrophyum plantagineum (Cav.) Kaulf. *Smith 6279*, from the escarpment north of Nandarivatu, Mba, Viti Levu, is a small plant with short stipes. It may be a distinct species.

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ADDITIONAL NOTES ON THE FIJIAN SPECIES OF PEPEROMIA

T. G. YUNCKER

SINCE MY PREVIOUS PUBLICATIONS dealing with the genus *Peperomia* in Fiji,¹ new collections have resulted in the discovery of noteworthy material. Most of the specimens mentioned in the present paper were collected in 1947 by Dr. A. C. Smith,² but one new species is based upon a collection by Mr. B. E. V. Parham, of the Department of Agriculture, Suva. It seems advisable at this time to propose a revised key to the species known to occur in Fiji; following this, the recently available material is detailed and three species and three varieties are described as new. Types of novelties are deposited in the herbarium of the Arnold Arboretum, and duplicates of Dr. Smith's collections of *Peperomia* are in the herbarium of DePauw University.

KEY TO THE FIJIAN SPECIES OF PEPEROMIA

Leaves predominantly opposite or verticillate.

Leaves moderately to densely hirtellous.....*P. leptostachya*.

Leaves glabrous or at most with only a few hairs.

Stems with nodal thickenings; leaves 1.2 cm. wide \times 3 cm. long...

.....*P. nodosa*.

Stems without nodal thickenings; leaves mostly more than 2.5 \times 3 cm.....*P. pilostigma*.

Leaves predominantly alternate.

Spikes sympodial (leaf-opposed).

Plants glabrous.....*P. flexuosa*.

Plants densely hirtellous.....*P. vitilevuensis*.

Spikes axillary and/or terminal.

Plants obviously and mostly more or less completely hairy.

Plants mostly 5 cm. or less tall; petioles up to 2-2.5 cm. long..

.....*P. orbiculimba*.

Plants much larger; petioles shorter.

Spikes mostly solitary (not in branching axillary clusters).

Leaves palmately 3-nerved, oval or obovate.

Leaves up to 2 \times 3.5 cm.; stem densely hairy, the

hairs up to 1 mm. long; spikes up to 7 cm. long;

peduncle 12 mm. long.....*P. nandarivatensis*.

Leaves 1.1 \times 1.7 cm.; stem minutely puberulent;

spikes up to 1.4 cm. long; peduncle 3 mm. long..

.....*P. curtispica*.

¹ Bishop Mus. Bull. 141: 25-47, fig. 8-20. 1936; Bishop Mus. Occ. Pap. 17: 215-220, fig. 1-3. 1943.

² Dr. Smith's collections were made under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

- Leaves palmately 5-nerved.
 - Leaf apex acute to narrowly acuminate.
 - Stem hairs erect.....*P. Parhamii*.
 - Stem hairs appressed.....*P. vitiana*.
 - Leaf apex obtuse to acutish; plants appressed-hirsute.....*P. ciliifolia*.
- Spikes in branching axillary clusters, occasionally solitary.
 - Stems long-villous; inflorescence usually of 3 umbellately clustered spikes.....*P. naitasiriensis*.
 - Stems hirtellous; inflorescence not umbellate.....*P. nandalana*.
- Plants essentially glabrous or at most with only a few hairs.
 - Leaves cordate-ovate; fruit longitudinally ribbed...*P. pellucida*.
 - Leaves and fruit not as above.
 - Leaves palmately 3-5-nerved, essentially glabrous.
 - Spikes mostly solitary; leaves not exceeding 4 cm. in length.
 - Plants suberect, glabrous; leaves briefly attenuate, mostly more than 2.5 cm. long.....*P. Endlicheri* var. *fijiana*.
 - Plants decumbent, spreading, minutely puberulent; leaves not attenuate, less than 1.5 cm. long....*P. curtispica*.
 - Spikes mostly in branching axillary clusters; leaves mostly larger.
 - Leaves mostly less than 2.5 cm. wide and 3 or more times longer than wide (less in var. *microlimba*).....*P. lasiostigma*.
 - Leaves up to 4 cm. wide and mostly less than 3 times longer than wide.....*P. kandavuana*.
 - Leaves mostly plinerved, glabrous or sparingly hairy.
 - Leaves plinerved within the lowermost 5 mm.
 - Leaves narrowly and attenuately acuminate, the upper surface glabrous; inflorescence branched and disposed along the stem.....*P. attenuata*.
 - Leaves acute to acuminate, hirtellous along the nerves on the upper surface; inflorescence mostly in the upper leaf axils.....*P. flavida*.
 - Leaves with the main lateral nerves branching off the midrib 5-10 mm. above the base.
 - Stems with many branches; leaves mostly about twice as long as wide.....*P. Albertiana*.
 - Stems mostly unbranched; leaves 3-5 times longer than wide.....*P. laevilimba*.

Peperomia leptostachya Hooker & Arnott in Bot. Beechey 96. 1832.

VITI LEVU: Mba: Vicinity of Nalotawa, eastern base of Mt. Evans Range, epiphyte in forest along creek, alt. 550-600 m., *Smith* 4433; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, on boulders in crest thickets, alt. 700-900 m., *Smith* 4296.

VANUA LEVU: Mathuata: Mt. Uluimbau ["The Three Sisters"], south of Lambasa, stems pink to red, on cliffs and boulders on exposed summit, alt. 150–369 m., *Smith 6605*.

This species is widely distributed on the islands of the Pacific area. It is found most commonly on rocks and cliffs at low to moderate altitudes.

***Peperomia vitilevuensis* sp. nov.**

Herba sat parva epiphytica; caule ad 15 cm. alto, conferte hirtulo; foliis alternis, ellipticis, ca. 1.5 cm. latis, 1.5–4 cm. longis, apice truncato-acutis, basi acutis, utrinque puberulis, ciliolatis, palmatim 3–5-nerviis; petiolo 3–5 mm. longo, hirtulo; spicis oppositifoliis; pedunculo gracili, 3–5 mm. longo, hirtulo; drupa globosa, stigmatum subapicali.

A rather small, epiphytic herb; stem up to 15 cm. tall, branching, sub-erect, 2 mm. thick at the base when dry, densely hirtellous, the internodes mostly 10–15 mm. long; leaves alternate, elliptic, mostly 1.2–1.8 cm. wide \times 1.5–4 cm. long, the apex bluntly acute, the base acute, puberulent on both sides, ciliolate, palmately 3–5-nerved, the nerves branched upward, moderately dark-glandular dotted, drying membranous, translucent; petiole about 5 mm. long, hirtellous; spikes leaf-opposed, 1 mm. thick \times 15–20 mm. long, moderately to loosely flowered; peduncle slender, 3–5 mm. long, hirtellous; rachis glabrous; bracts round-peltate; drupe globose, about 0.5 mm. long, the apex oblique, the stigma slightly subapical.

VITI LEVU: Mba [formerly Tholo North]: Summit of Mt. Nanggara-nambuluta [Lomalangi], east of Nandarivatu, epiphyte in dense forest, alt. 1100–1120 m., June 23, 1947, *Smith 4862* (TYPE, in Arnold Arb. herbarium). Ra [formerly Tholo North]: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi [Mt. Victoria], stem and leaves frequently reddish-mottled, epiphyte in dense forest, alt. 1050–1120 m., *Smith 5711*.

The comparatively small, densely hirtellous plants, and especially the sympodial spikes distinguish this species. From *P. flexuosa*, which also has leaf-opposed spikes, it differs because of its densely hirtellous stems.

***Peperomia orbiculimba* Yuncker var. *mathuataensis* var. nov.**

Foliis orbicularibus vel elliptico-obovatis, 1–2.5 cm. latis, 1–3 cm. longis, apice rotundatis, obtusis, basi obtusis vel acutis; petiolo gracili, ad 6 cm. longo (pro more 1–2.5 cm.); pedunculo ad 2 cm. long.

Leaves from orbicular to elliptic-obovate, 1–2.5 cm. wide \times 1–3 cm. long, the apex rounded, the base obtuse to acute; petioles slender, mostly 1–2.5 cm. or rarely up to 6 cm. long; peduncle up to 2 cm. long.

VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, on rocky banks along stream in dense forest, alt. 100–250 m., Dec. 4, 1947, *Smith 6859* (TYPE, in Arnold Arb. herbarium); southern slopes of Mt. Numbuiloa, east of Lambasa, leaf-blades reddish purple beneath, on cliffs in steep open forest, alt. 350–500 m., *Smith 6569*.

There is great variation in the size and shape of the leaves on the specimens included here. The leaves on the type specimen of the species, collected near Levuka on Ovalau, are only about 1 cm. long and orbicular or

nearly so. Some leaves on the type specimen of this variety resemble those of the species but most of them are much larger and somewhat obovate while those on no. 6569 are mostly elliptic-obovate. All agree, however, in being small plants with villous stems and leaves, and in having long, slender petioles and peduncles, and somewhat pointed fruits.

Peperomia nandarivatensis Yuncker in Bishop Mus. Occ. Pap. 17: 216, fig. 1. 1943.

VITI LEVU: Mba [formerly Nandi]: Upper slopes of Mt. Koromba [Pickering Peak], on boulders in dense forest, alt. 800–1075 m., *Smith* 4670.

Peperomia curtispica C. DC. in Jour. Linn. Soc. 39: 166. 1909.

VITI LEVU: Mba [formerly Tholo North]: Summit of Mt. Nanggara-nambuluta [Lomalangi], east of Nandarivatu, epiphyte in dense forest, alt. 1100–1120 m., *Smith* 4861; hills east of Nandala Creek, about 3 miles south of Nandarivatu, epiphyte in dense mossy forest on ridge, alt. 850–970 m., *Smith* 5948. Nandronga & Navosa [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, epiphyte in dense forest, alt. 725–825 m., *Smith* 5515. Ra [formerly Tholo North]: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi [Mt. Victoria], epiphyte in dense forest, alt. 1050–1120 m., *Smith* 5710. Naitasiri [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, nodes deep red, epiphyte in dense forest, alt. 870–970 m., *Smith* 5772.

This is a small, decumbent, epiphytic species rather common in densely forested areas. Considerable variation is shown in the size and shape of the leaves on individual plants.

Peperomia Parhamii sp. nov.

Herba epiphytica statura modica erecta vel suberecta; caulis conferte hirtulis; foliis alternis vel infimis oppositis vel verticillatis, ellipticis, elliptico-lanceolatis vel subobovatis, infimis obovatis, apice angustatis acutis vel infimis obtusis, palmatim 5-nerviis, utrinque hirtulis (ad venas saltem); petiolo 3–10 mm. longo, conferte hirtulo; spicis terminalibus et axillaribus; pedunculo dissite hirtulo; ovario ovoideo, apice obliquo, stigmatibus subapicali.

A moderate-sized erect or suberect epiphytic herb; stem succulent, 5 mm. thick when dry, up to 30 cm. or more tall, strongly branched upward, densely hirtellous, hairs erect, the internodes 1 cm. long above, up to 4 cm. downward; leaves alternate or those on the lower nodes opposite or whorled, the upper leaves elliptic, lance-elliptic or subobovate, the lower whorled leaves obovate, quite variable in size, the upper leaves about 1.2 cm. wide \times 2.5 cm. long, the lower leaves up to 2–2.5 cm. wide \times 3–4 cm. long, the apex narrowed, acute, or lower obovate leaves scarcely pointed and obtuse, palmately 5-nerved, hirtellous on both sides, especially along the nerves, dark above, paler and strongly dark-glandular-dotted beneath, ciliolate above the middle, drying rather thin, translucent; petioles mostly 3–5 mm. long above, up to 1 cm. on the larger lower leaves, densely hirtellous; spikes axillary and terminal, moderately flowered, 1 mm. thick

× 3 cm. long; peduncle about 5 mm. long, loosely hirtellous; bracts round-peltate; ovary ovoid, the apex oblique, the stigma subapical; fruit not present.

VITI LEVU: Namosi: Korombasambasanga Mt., alt. 1050 m., Mar. 24, 1940, B. E. Parham 2187 (TYPE, in Arnold Arb. herbarium).

This species resembles *P. nandarivatensis* to some extent but differs because of the larger size of the plants, shorter pubescence, leaf shape and pubescence, shorter peduncles, etc. From *P. vitiana* it differs in the size and shape of the leaves and the character of the pubescence.

Peperomia naitasiriensis sp. nov.

Herba epiphytica; ramis e basi decumbente radicante ad 35 cm. vel ultra sat conferte albo-villosis, pilis ad 1 mm. vel ultra longis erectis; foliis alternis distichis ellipticis vel elliptico-lanceolatis, apice acutis acuminatis, basi acutis, utrinque dissite villosis, palmatim 5-nerviis; petiolo conferte villoso; inflorescentia umbellata; spicis 5–10 mm. longis; pedunculo gracili glabro vel dissite villoso.

An epiphytic herb, branching from the rooting, decumbent base, the branches simple, virgate, 3 mm. thick at the base when dry, up to 35 cm. or more long, rather densely white-villous, the hairs erect, up to 1 mm. or more long, the internodes about 1 cm. long; leaves alternate, distichous, elliptic or lance-elliptic, 1–1.4 cm. wide × 3–4.5 cm. long, gradually reduced upward, the apex acute to acuminate, the base acute, loosely villous on both sides, ciliate, palmately 5-nerved, the lateral nerves slender, dark above, pale beneath, drying thin and membranous; petiole 2–3 mm. long, densely villous; spikes as yet young, scarcely 1 mm. thick × 5–10 mm. long, moderately flowered, mostly in umbellate clusters of three, subtended by a lanceolate bract with an apical tuft of hairs, on slender, axillary, loosely villous stalks about 3 mm. long, or uppermost spikes may be solitary; peduncle slender, up to 5 mm. long, glabrous or sparsely villous; bracts round-peltate; ovary turbinate (?), the stigma apical (?); fruit not present.

VITI LEVU: Naitasiri [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, apparently rare and seen only once, stems and lower leaf-surfaces reddish-tinged, epiphyte in dense forest, alt. 870–970 m., Sept. 18, 1947, Smith 6144 (TYPE, unicate in Arnold Arb. herbarium).

The long-villous stems and leaves and the umbellate inflorescence distinguish this species from other known Fijian species.

Peperomia nandalana Yuncker var. *nudipeduncula* var. nov.

Foliis ellipticis, obovato-ellipticis rhombeisve, ca. 1.5 cm. latis, 2.5–4 cm. longis, apice acutis vel subobtusis, basi acutis, utrinque sat crispo-puberulis; spicis 5–10 mm. longis; pedunculo glabro.

Leaves elliptic or elliptic-obovate or rhomboidal, 1.2–1.7 cm. wide × 2.5–4 cm. long, the apex acute or obtusish, the base acute, moderately to sparingly crisp-puberulent on both sides; spikes 1 mm. thick × 5–10 mm. long; peduncle glabrous.

VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, on rocky banks along stream in dense forest, alt. 100–250 m., Dec. 4, 1947, *Smith 6862* (TYPE, in Arnold Arb. herbarium).

This variety resembles the species in many respects but differs because of the smaller size of the plants, shape and size of the leaves, and glabrous peduncles. It differs from *P. vitiana* because of the erect stem hairs, less pointed leaves and shorter spikes which are commonly multiple on axillary stalks.

Peperomia lasiostigma C. DC. in Jour. Linn. Soc. 39: 165. 1909.

VITI LEVU: Mba [formerly Tholo North]: Hills between Nggaliwana and Nandala Creeks, south of Nauwanga, nodes deep red, internodes green or sometimes reddish-flecked, on trees and boulders in dense forest, alt. 725–850 m., *Smith 5810*; hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, nodes purplish, internodes reddish-tinged, spikes dull red, epiphyte in dense forest, alt. 750–850 m., *Smith 6191*; slopes of the escarpment north of Nandarivatu, nodes purplish, spikes red-tinged, on rocks in woods along stream, alt. 550–800 m., *Smith 6266* (some leaves and parts of the stems are minutely hirtellous); valley of Nggaliwana Creek, north of the sawmill at Navai, nodes and spikes red, internodes and petioles red-tinged, epiphyte in dense forest, alt. 725–850 m., *Smith 5347*; western and southern slopes of Mt. Tomanivi [Mt. Victoria], branches reddish, epiphyte in dense forest, alt. 850–1150 m., *Smith 5268*; summit of Mt. Tomanivi [Mt. Victoria], branches pale green with faint red longitudinal stripes, epiphyte in dense mossy forest, alt. 1290–1323 m., *Smith 5197*; western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, nodes dull red, internodes, leaves, and spikes green, sometimes reddish-tinged, epiphyte in dense forest, alt. 850–1000 m., *Smith 6306a*; same locality, alt. 1000–1100 m., *Smith 4896*; eastern slopes of Mt. Koroyanitu, Mt. Evans Range, epiphyte in dense low forest, alt. 950–1050 m., *Smith 4145*. Mba [formerly Nandi]: Upper slopes of Mt. Koromba [Pickering Peak], on rocks in dense forest at crest, alt. 800–1075 m., *Smith 4699*. Nandronga & Navosa [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, nodes swollen, deep red, epiphyte in dense forest, alt. 725–825 m., *Smith 5596*. Naitasiri [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, nodes, internodes and sometimes lower leaf-surfaces reddish-streaked, epiphyte in dense forest, alt. 870–970 m., *Smith 5773, 6107*.

Peperomia lasiostigma var. *carnosa* (C. DC.) Yuncker in Bishop Mus. Bull. 141: 36. 1936.

VITI LEVU: Ra [formerly Tholo North]: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi [Mt. Victoria], stems often deep red, up to 1 cm. diameter near the base, epiphyte in dense forest, alt. 1050–1120 m., *Smith 5720*. Mba [formerly Tholo North]: Ridge between Mt. Nanggaranambuluta [Lomalangi] and Mt. Namama, east of Nandarivatu, stems reddish, epiphyte in dense forest, alt. 1050–1120 m., *Smith 4985*; western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, nodes dull red, internodes, leaves, and spikes green, sometimes reddish-tinged,

epiphyte in dense forest, alt. 850–1000 m., *Smith 6306*; summit of Mt. Tomanivi [Mt. Victoria], stems and branches deep red, succulent, epiphyte in dense mossy forest, alt. 1290–1323 m., *Smith 5148*.

There is some question whether the specimens listed above as variety *carnosa* are identical with the original *P. carnosa* C. DC. or not. They appear to agree sufficiently well with the original description and a photograph of the type, however, to warrant placing them here, at least questionably.

***Peperomia lasiostigma* var. *tomaniviensis* var. nov.**

Herba divaricatum ramosa; caule ad 40 cm. adscendente; foliis ellipticis vel inferis elliptico-subobovatis, 1–1.5 cm. latis, 2.5–3 cm. longis, apice abrupte brevi-acutis; petiolo gracili, ca. 5 mm. longo.

Stems divaricately branched upward, up to 30 cm. tall; leaves elliptic or lower leaves elliptic-subobovate, 1–1.5 cm. wide \times 2.5–3 cm. long, the apex abruptly short-acute; petioles slender, about 5 mm. long.

VITI LEVU: Mba [formerly Tholo North]: Western and southern slopes of Mt. Tomanivi [Mt. Victoria], epiphyte in dense forest, alt. 850–1150 m., July 7, 1947, *Smith 5114* (TYPE, Arnold Arb. herbarium); hills east of Nandala Creek, about 3 miles south of Nandarivatu, epiphyte in dense forest, alt. 850–970 m., *Smith 6242*.

These specimens resemble *P. lasiostigma* in being glabrous and having axillary, compound inflorescences. They differ because of the shape and smaller size of the leaves and more slender petioles. The stems are also more erect and more widely branched upward.

***Peperomia kandavuana* Yuncker in Bishop Mus. Bull. 141: 39, fig. 15. 1936.**

VITI LEVU: Mba [formerly Tholo North]: Hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, internodes pinkish, nodes purplish red, young spikes reddish, on humus-covered boulders in dense forest, alt. 725–800 m., *Smith 5885*. Naitasiri [formerly Tholo North]: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, internodes green, nodes deep red, epiphyte in dense forest, alt. 870–970 m., *Smith 5782*.

The fruit on the type specimen of this species is well developed with the stigma appearing to be nearly apical. The fruit on no. 5885 is immature but the ovaries show an oblique apex with the stigma somewhat subapical. No other difference has been noted, however, and it is believed that it is the same as this species.

DEPT. OF BOTANY,

DEPAUW UNIVERSITY.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1949

Horticulture.—The Arnold Arboretum plantings have been kept in good condition during the past year. Extensive pruning work has been done and weed trees and shrubs have been removed on the South Street bank in the juniper and yew collections. Commercial fertilizer was applied to the collections of magnolias, Japanese maples, elms, euonymus, sorbus, rhododendrons, and to the shrub collection. Mulching of trees and shrubs with hops has been continued, and has been very effective in promoting growth, suppressing weeds and preventing grass fires from killing shrubs and small trees. The control of grass growth by constant mowing with the "blitzer" has also reduced fire hazards and improved the appearance of the grounds. Various weed killers, Solvasol, Ammate, Esteron 44, and Dow 2-4-5 T have been used in an effort to eliminate poison ivy and shrubby weeds, and to control weeds in the cultivated areas.

Two of the major projects supported by funds from the Friends of the Arnold Arboretum are nearly completed. More than three hundred azaleas and other ericaceous shrubs have been planted in the new border along the Meadow Road. Several hundred ground cover plants were planted in adjacent areas.

The vine collection has been moved to the Arborway wall, and the unsightly trellis in the shrub collection has been removed. A new tree peony collection was planted near the Wisteria arbor, and includes thirty varieties not previously grown in the Arboretum.

The rehabilitation of the Peters Hill area, made possible by contributions from John Ames, is progressing satisfactorily. More than two thousand superfluous or decrepit trees have been removed, and the small shrubs and seedlings were sprayed with weed killers. A soil improvement program was started to insure an adequate sod cover which would prevent erosion and excessive invasion of weed trees. The hiring of heavy equipment for much of this work was necessary and the cost has been excessive. Other methods will be used on the alternate contour strips. We hope to establish a good grass cover and begin a planting program in 1950.

A number of surplus plants were given to Harvard University and Radcliffe College, and several truck loads of surplus nursery stock were given to the Massachusetts State Hospital for Crippled Children. More than 60 plants of new varieties originating in the Arnold Arboretum were distributed to cooperating nurserymen. Plants, and seeds of woody plants have been received from nurserymen and from botanic gardens.

The Case estates in Weston have been of great value in our nursery trials, testing plots, and for permanent nurseries of surplus stock. Various types of horticultural experiments are conducted here. About seven acres

are devoted to a forest tree test plot under the auspices of the Cabot Foundation. The Weston Garden Club did the major work in maintaining the perennial garden, and distributed the flowers to the Veterans' and the Waltham Hospitals. The Division of Landscape Architecture continues to use some of the Case land for demonstration work.

The bulletin of popular information, "Arnoldia" was continued as usual. A new Guide, "Through the Arnold Arboretum" was written, and five thousand copies were printed. Dr. Wyman's new book, "Shrubs and Vines for American Gardens" was published by the Macmillan Company in May 1949. The field class held in the fall attracted thirty-five members, while the spring class held on Saturday mornings drew about thirty students.

Several hundred apple and cherry hybrids have been grown and are now in test plots. Several of the new apple hybrids selected for further trial have been found to be apomictic and breed true from seed. New triploid forsythia hybrids appear to be very promising. Few of the rose hybrids have been of value. Work on dwarfing rootstocks is being continued.

Comparative Morphology. — Professor Bailey and his co-workers have continued their investigations of the comparative morphology of various dicotyledonous families. Carefully preserved material of *Austrobaileya* collected by Mr. L. J. Brass and Mr. S. E. Stephens in Queensland enabled Professor Bailey and Dr. Swamy to make a thorough study of this phylogenetically significant genus. Its secondary phloem is remarkable in being composed of sieve cells and phloem parenchyma strands, and in having *no companion cells*. Its nodal anatomy is of an unusual type resembling that which occurs in *Trimenia* and *Piptocalyx* of the Monimiaceae. Its summation of vegetative and floral characters indicates that it is closely related to, if not actually a member of this family. Dr. Swamy has found two vesselless representatives of the Chloranthaceae. These plants, together with *Amborella* described earlier in the year, raise the number of surviving primitive, vesselless, dicotyledonous genera to ten in five families. It is evident that considerable floral diversification in dicotyledons occurred before the evolution of vessels in the xylem.

The Herbarium. — During the past year 11,282 specimens were mounted and added to the herbarium. The organized herbarium now contains 645,770 mounted specimens.

Accessions during the fiscal year numbered 46,111 specimens, of which 15,545 came in exchange, 25,016 through purchase or subsidy, 3429 by gifts, and 2121 in return for identification. Most of this material comes from southeastern Asia and the Pacific area, or more precisely from continental Asia (10,629 specimens), northern Australia (12,295 specimens), and Polynesia, Micronesia, and Malaysia (10,708 specimens). It very greatly enriches the superb facilities for botanical research on the Pacific and Asiatic floras already available at the Arboretum. Among the more

important individual accessions are the 11,928 specimens from northern Australia made by L. J. Brass on the 1948 Richard Archbold Expedition to Cape York; 2233 plants of Hosokawa collections in Micronesia received through Dr. H. L. Li from the National Taiwan University; 1338 photographs of types and other critical specimens in Formosan herbaria obtained through the courtesy of Prof. Ying Tsiang; 1200 of Mrs. Clemens' collections from Papua received from the Botanical Museum, Berlin-Dahlem; 1447 chiefly classic Malaysian collections received from the Rijksherbarium, Leiden, and 2115 photographs of South American types received from the Chicago Museum of Natural History. Some other important accessions are 2784 Polynesian plants from the Bernice P. Bishop Museum, Honolulu; 2985 plants of Yunnan from the Fan Memorial Institute, Peiping; and 650 plants of Szechuan from the University of Chengtu, Szechuan.

A total of 30,591 specimens were sent out from the herbarium during the year, of which nearly half (6684 mounted and 6992 unmounted specimens) consisted of American tropical material transferred to the Gray Herbarium. In exchange, 2892 specimens were sent to American and 6932 to foreign institutions.

The Arboretum received thirty-five requests for the loan of its herbarium material. Of these twenty-six came from a total of 14 American institutions and nine from six foreign botanical establishments. A total of 7031 specimens was involved. For the use of the Arboretum staff 6776 specimens were borrowed from other institutions, constituting seventeen loans from seven American and twelve loans from seven foreign institutions.

Professor Rehder completed the proof reading for his monumental "Bibliography of Cultivated Trees and Shrubs," which was finally printed and issued in the closing fortnight of the fiscal year. The work represents about ten years of bibliographic research and will long remain an indispensable tool in horticultural and herbarium taxonomy.

Dr. Merrill completed the final proof reading of his definitive catalogue of the botanical work of Rafinesque. With his work on this large project finished, he turned to herbarium studies, and especially to the organization and identification of large collections recently received from the Philippines. Dr. Johnston worked on West Indian and Central American Boraginaceae and prepared an account of the family for the "Flora of Trinidad and Tobago." Dr. Kobuski has progressed in his studies of the Theaceae despite very heavy editorial duties. Dr. Perry has organized the very large collections made by Brass on Cape York and now has readied for distribution many of the named duplicates now on hand from New Guinea.

Overshadowing in importance all other activities of the herbarium staff has been the formulation of final plans for the new building in Cambridge which is to house the combined herbaria and libraries of the Arnold Arboretum and the Gray Herbarium. Dr. Johnston, Dr. Kobuski, and Mrs. Schwarten have been particularly active in this project. Their

routine work has tended more and more to be directed towards readying the herbarium and library for the anticipated move to Cambridge.

Two members of the herbarium staff resigned during the fiscal year. Dr. Allen left in August 1948 because of illness in her family. Dr. Smith terminated his appointment in September to assume a curatorial post at the U. S. National Museum.

The Library. — During the fiscal year ended June 30, 1949, 267 bound volumes were added to the library, bringing the total up to 47,033; 207 pamphlets were catalogued and filed, bringing that total to 14,355. Five hundred and thirty catalogue cards were added to the main catalogue; 4,885 to the Gray Herbarium new species cards. A shelf list was made for the monograph section of the library.

The monographs have been reclassified and rearranged according to the Dalla Torre & Harms system, thus enabling taxonomists to find the necessary work filed under the same number as the herbarium specimen is filed in the herbarium.

A high school student has worked in the library after school hours and on Saturdays, dusting the books and shelves with a vacuum cleaner. Minor book repairs were made at this time; major ones going to the bindery (some seventy volumes were restored or repaired by the binder).

The photograph collection has been enriched by about 275 pictures taken in the Arnold Arboretum by the Horticulturist and his assistant.

Inter-library loans have been about the same as in previous years; numerous requests for typed descriptions, microfilms and photostats, as well as prints from our collection of Microfilms of war-lost German periodicals.

Financial report. — The Arnold Arboretum received during the year \$3,333.33 from the Georgiana Wells Sargent bequest, \$63,198.45 from the Louisa W. Case estate, and \$1,379.78 from the Marian R. Case estate. These funds were added to endowment. Gifts for current use included \$8,969.00 from the Friends of the Arnold Arboretum, \$340.00 for the Rafinesque Publication Fund, \$2,000.00 for the Chinese Exploration Fund, and \$100.00 for special travel funds.

The total income for the year was \$179,328.41 and total expenditures were \$193,897.28. The apparent deficit was due to the fact that special grants for horticulture and publications built up in former years were drawn on heavily during the past year.

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KARL SAX,
Director

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1948—49

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* Deceased, May 20, 1949.

† Deceased, July 21, 1949.

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